COMPUTING FOR BUSINESS AND HOME

INTERFACE AGE™

MARCH 1982 $2.50/CANADA/MEXICO $3.00

7/82

Computer User Options: TIMESHARING

Timesharing vs. Buying

Mail Order vs. Retail Stores

New Products Directory

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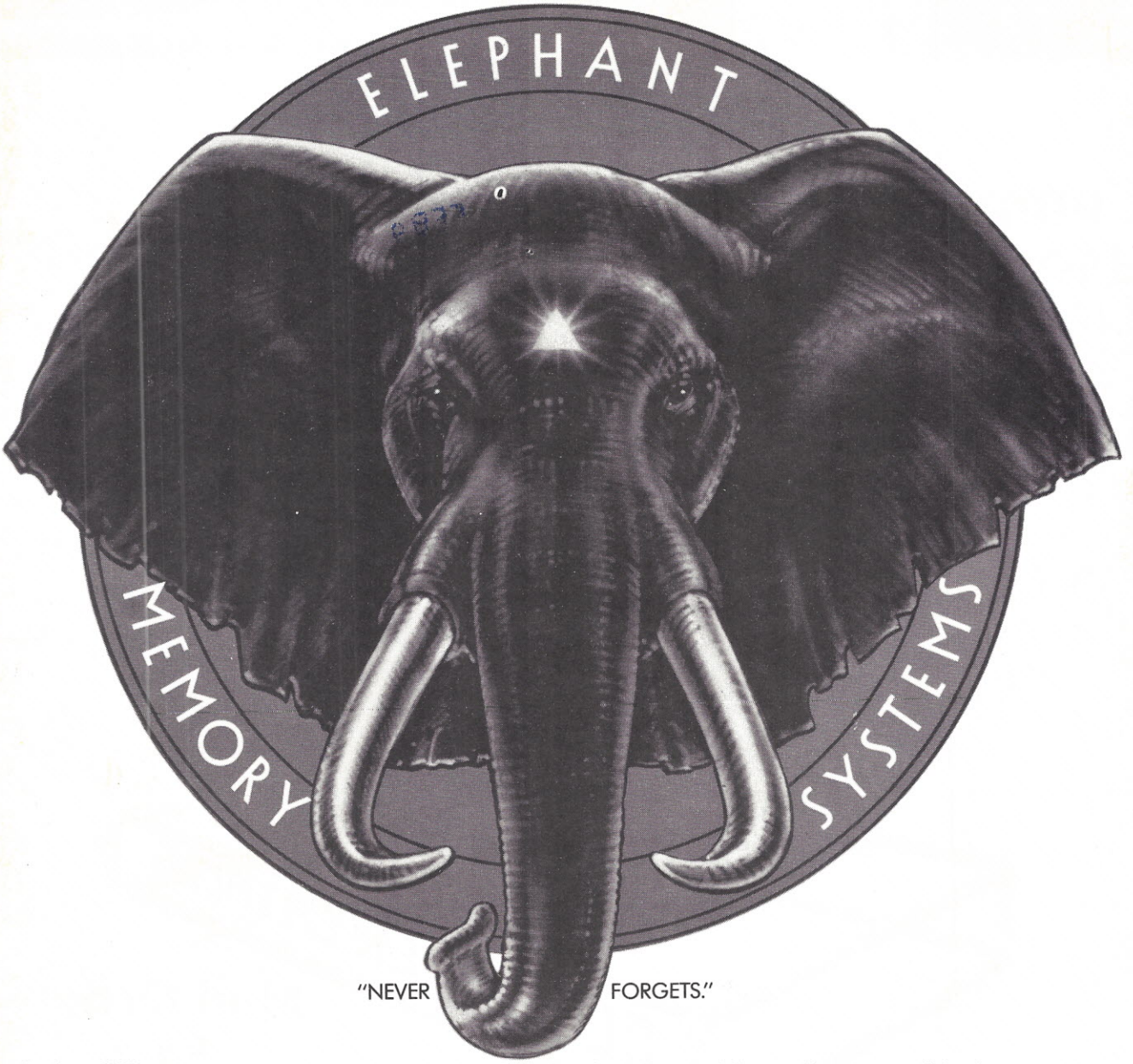

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CIRCLE INQUIRY NO. 49

New Cromemco System One shown with our high-capability terminal and printer.

A new small computer that won't limit you tomorrow

Here's a low-priced computer that won't run out of memory capacity or expandability halfway through your project.

Typically, computer usage tends to grow, requiring more capability, more memory, more storage. Without a lot of capability and expandability, your computer can be obsolete from the start.

The new System One is a real building-block machine. It has capability and expandability by the carload.

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- **Z80-A processor**
- **64K of RAM**
- **780K of disk storage**
- **CRT and printer interfaces**
- **Eight S-100 card slots, allowing expansion with**
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  - **— additional memory**
  - **— additional interfaces for telecommunications, data acquisition, etc.**
- **Small size**

GENEROUS DISK STORAGE

The 780K of disk storage in the System One Model CS-1 is much greater than what is typically available in small computers. But here, too, you have a choice since a second version, Model CS-1H, has a 5" Winchester drive that gives you **5 megabytes** of disk storage.

MULTI-USER, MULTI-TASKING CAPABILITY

Believe it or not, this new computer even offers multi-user capability when used with our advanced CROMIX* operating system option. Not only does this outstanding O/S support multiple users on this computer but does so with powerful features like multiple directories, file protection and record level lock. CROMIX lets you run multiple jobs as well.

In addition to our highly-acclaimed CROMIX, there is our CDOS*. This is an enhanced CP/M† type system designed for single-user applications. CP/M and a wealth of CP/M-compatible software are also available for the new System One through third-party vendors.

COLOR GRAPHICS/WORD PROCESSING

This small computer even gives you the option of outstanding high-resolution color graphics with our Model SDI interface and two-port RAM cards.

Then there's our tremendously wide range of Cromemco software including packages for word processing, business, and much more, all usable with the new System One.

ANTI-OBSOLESCENCE/LOW-PRICED

As you can see, the new One offers you a lot of performance. It's obviously designed with anti-obsolescence in mind.

What's more, it's priced at only $3,995. That's considerably less than many machines with much less capability. And it's not that much more than many machines that have little or nothing in the way of expandability.

Physically, the One is small — 7" high. And it's all-metal in construction. It's only 14⅛" wide, ideal for desk top use. A rack mount option is also available.

CONTACT YOUR REP NOW

Get all the details on this important building-block computer. Get in touch with your Cromemco rep now. He'll show you how the new System One can grow with your task.

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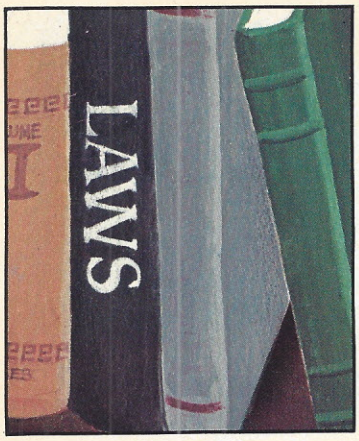
VOL. 7, ISSUE 3
SINCE DECEMBER 1975

MARCH 1982

INTERFACE AGE™

COMPUTING FOR BUSINESS AND HOME APPLICATIONS



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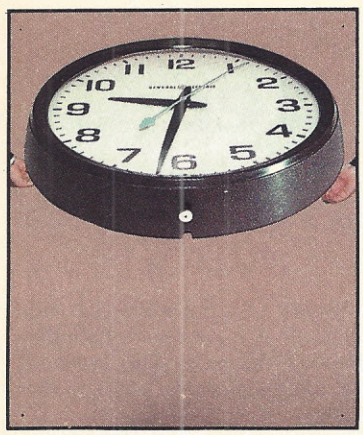

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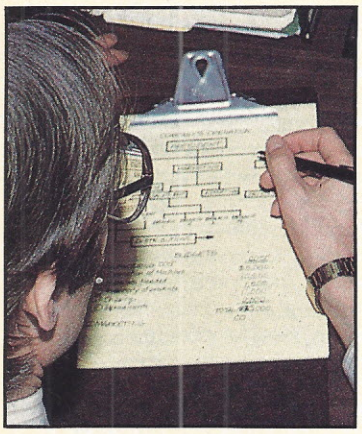

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Contact authors of monthly columns by writing to them at INTERFACE AGE, P.O. Box 1234, Cerritos, CA 90701, in care of their respective columns.

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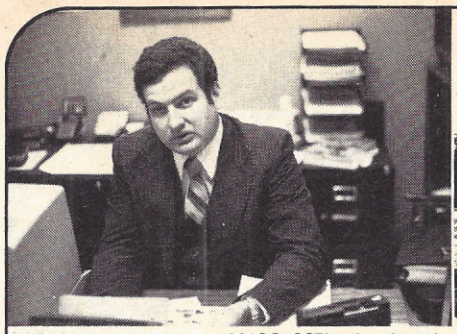
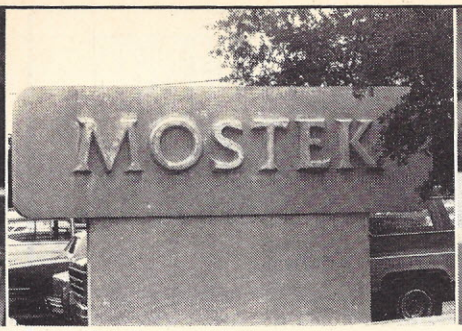
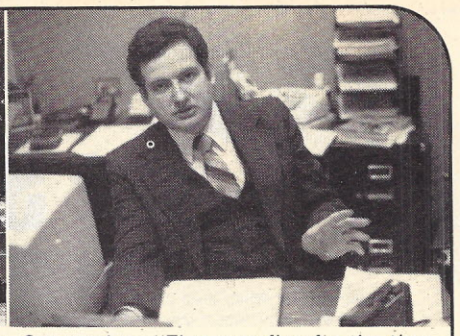
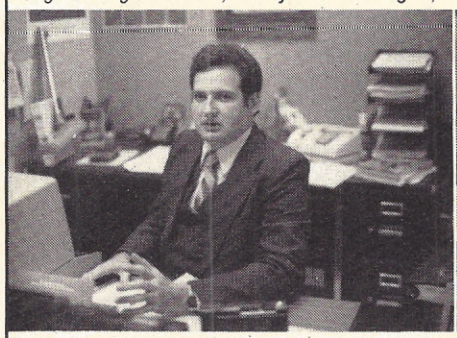
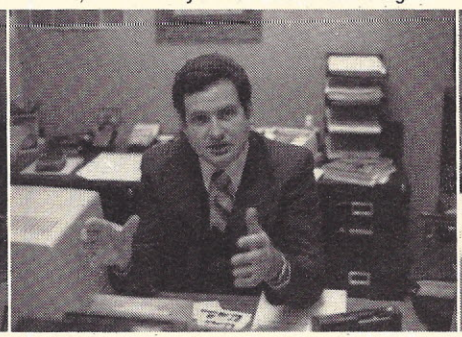




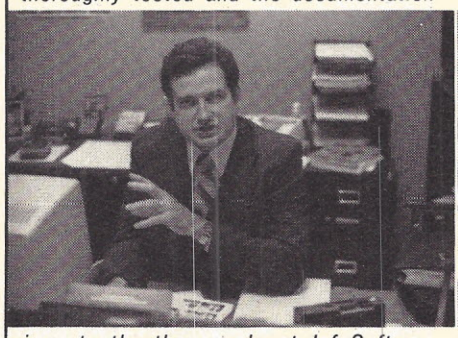


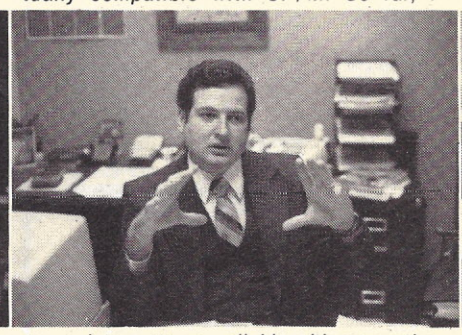
"Before we went to M/OS-80™, deve!oped for us by InfoSoft, we had a system that was engineering oriented," says Bill Vaughn, Applications Engineer, Micro Systems department of Mostek Corporation, Carrollton, Texas, subsidiary of United Technologies Corporation. *"That was fine for the time, but the market has grown and matured and we needed a more general purpose system.*

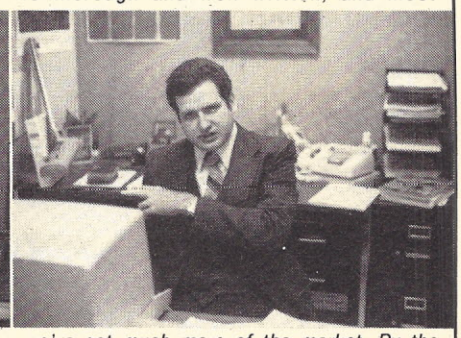




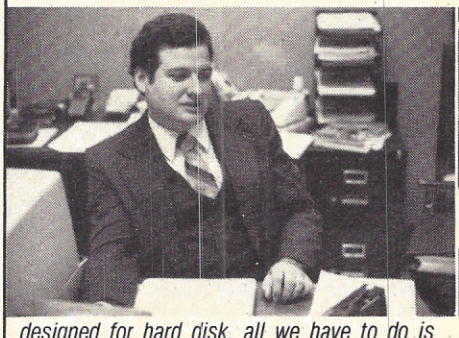
We looked at CP/M®, but InfoSoft's operating system was the answer for us. It has been thoroughly tested and the documentation clearly reflects that. We can allay any of our customers' fears because it's virtually compatible with CP/M. So far, I haven't found any packages that won't run under our M/OS-80. The documentation is thorough and well written, and most

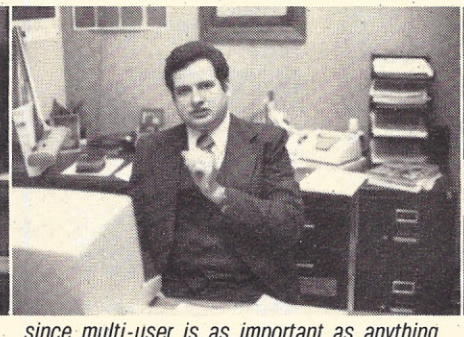


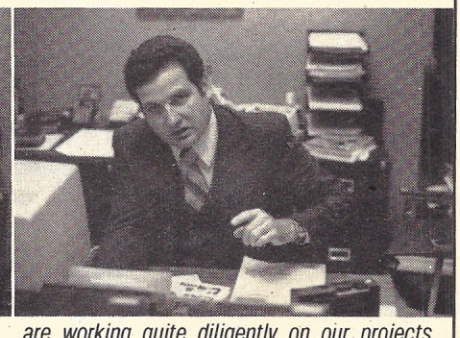




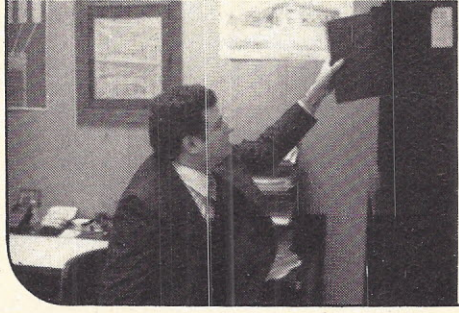
importantly, the people at InfoSoft are very responsive. Their operating system has additional system calls and has the ability to run interrupts unavailable with many other operating systems, which gives a real advantage to our customers. With our M/OS-80, we've got much more of the market. By the end of the year, we should have hard disk, and since the InfoSoft system was originally







designed for hard disk, all we have to do is reactivate those programs and sub-routines. We're talking to InfoSoft about MultI/OS too, since multi-user is as important as anything else in the whole industry. Their support has been excellent, they respond to our calls, and are working quite diligently on our projects. M/OS-80 has satisfied our requirements, and InfoSoft has been a significant factor in our progress."



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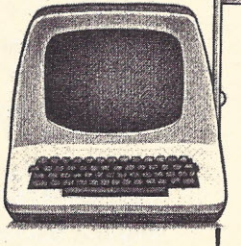

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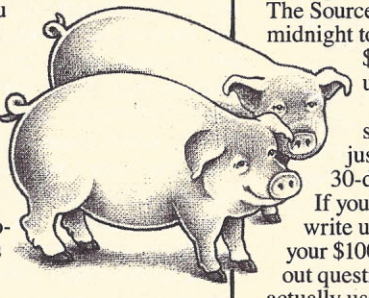

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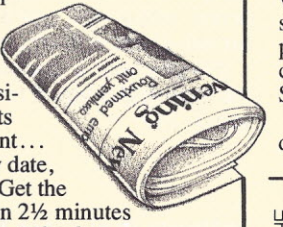

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EDITOR'S NOTEBOOK

An opportunity to speak out

In the day-to-day routine of running an editorial department (especially one that deals directly with consumer products), it becomes common to expect flak from dissatisfied merchandisers. Unless the editorial policy dictates writing about every product in superlative terms and painting the industry as a flawless Utopia, one can expect a steady influx of irate phone callers, distraught at the fact that a publication would dare print a disparaging word about their merchandise.

On a recent workday, two interesting calls came within one afternoon—calls that demonstrate the diverse standpoints that companies take in reacting to adverse criticism. The first call was from a company spokesperson, scolding us at great length about our irresponsibility in printing a reader letter that criticized his company's service. He complained that he had never been given a chance to respond to the allegations. (In checking our files, we confirmed that his company had, indeed, been sent a copy of the letter so that someone might respond, but no one ever did.) What was irritating and more than a little ironic was the lecture we received about editorial ethics. (This was advice from an individual who had just attempted to exert pressure on our editorial decisions by threatening to pull his advertising.)

Within two hours, another call came in response to a separate reader letter, but it boasted a refreshingly different tone. It was from Larry Marschall of San Jose, CA, who had written the published letter. In the letter, Marschall had expressed his opinion that the documentation on certain Radio Shack pocket computers was flawed. Marschall was calling to inform us that a spokesman from Tandy/Radio Shack had called him promptly after seeing his letter, in order to discuss Marschall's dissatisfaction with the manuals. As we seldom print the addresses of reader letters, Radio Shack had gone to the trouble of tracking Mr. Marschall down to hear his suggestions. And we heard nary a word of complaint from Radio Shack (also, incidentally, an *IA* advertiser).

If one company reacts with hysteria to a cross word in print, and another responds by trying to satisfy the customer (and improve the product), the situation says a lot about the uneven quality of after-sale support in the computer industry.

This is a problem we have been noting for quite some time, via feedback from end-users and manufacturers alike. We are doing what we can to publish honest reports on the available products and services, and we are enlisting *your* help in a special consumer-oriented project. On page 81 is a questionnaire that asks for specifications on the equipment you use and the kind of support you have received from merchandisers and/or manufacturers.

We feel that there is much value in a project like this, as the sharing of information will benefit everyone. Improved standards in customer service can only add to the strength of the entire industry. We will look for trends in the responses we receive: which companies are particularly bad about offering support to their customers; which are particularly strong; which areas of service generally need the most improvement. We hope that all readers who are concerned with after-sale support will take the time to supply us with the information we need.

We wish to clarify the fact that we are not equipped to serve as a consumer agency, nor to promise solving each individual's problem with a specific vendor. But we feel that the combined analysis of readers' experiences should reveal some interesting statistics that we can share with you in a future issue.

Will you take a few minutes to fill out the form and return it to us no later than March 31?

Software in sharper focus

Next month, our coverage of the business software market is increasing substantially. Carl Heintz's familiar and well-received *Business Software Review* column is undergoing an expanded treatment. The new monthly feature, *Business Software Forum*, will include extensive comparisons of available products, in-depth analyses of trends in the business software market, and Heintz's individual evaluations of specific business programs. The series leads off next month with a comprehensive look at accounting packages. Many leading products in the accounting field will be discussed on a feature-by-feature basis, with Heintz's personal observations added to the factual specifications.

In coming months, the series will take individual segments of the market and cover them thoroughly: finance planning, word processing, data base management systems and several others.

Early responses from software merchandisers to our first survey have been very encouraging. We think the new format will add a wealth of valuable information to Heintz's popular monthly feature.

—LS

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LETTERS

Consumers speak out

Regarding your question on consumer experiences with after-sale support ("Editor's Notebook" IA Dec 81), my purchases are from both mail order houses and local stores. If it is a significantly large program or piece of equipment, I will purchase it locally for two major reasons: I want prompt service, and I want to support the merchant who takes the trouble and risk of carrying and showing an inventory.

Office purchases for my law firm are from Data Resources; the company's product support is terrific. For my personal needs, I use Autel Electronics and the Radio Shack Computer Center. These people teach or do whatever is necessary.

Mail order experiences have generally been pretty good, and I am very pleased with the service and ethical standards of most of the vendors. These seem to be two major types: specialty houses and discount houses. The specialty houses tend to give better service than the discount houses. That shouldn't surprise people, because discount houses are offering low prices and little else.

One last observation: checking out a product at a local dealer, then buying from a discount house is the moral equivalent of software piracy, because one is getting something for nothing. And this is no moralistic carping either, because if enough people do it, the high service operations will fold and the discount folks take over. Computers are mysterious enough with lots of local service. I hope we don't force local service out of the market by paying too much attention to our wallets.

Robert A. Martin
Albuquerque, NM

I am most gratified to see that someone is at last expressing some concern for the lot of the consumer in the computer marketplace.

It seems apparent to me that dealers and manufacturers alike do not want to hear anything from you if you have a problem with their product. I believe this augurs badly for the future of personal computers. The individual consumer, as opposed to the business consumer, simply cannot afford to invest money in an "appliance" that doesn't work, and for which he has no recourse. Of course, the business consumer cannot afford this either, but, generally, he has recourses not available to the individual.

Walter J. Palmer, Ph.D.
New Bern, NC

Re: Editor's Notebook (IA Oct 81), I found the column of great interest, because I am representing several businesses in the state of Alaska who have found themselves the victims of unethical practices similar to those you describe in your column.

Nelson G. Page
Anchorage, AK

I recently returned a defective package of business software to Computer Services Corp. of America, New York, NY. This is apparently a reputable company that inadvertently sent out an updated package with bad bugs. I have since gotten a prompt refund with no difficulty.

In an effort to correct a bad impression, CSC is allowing me to evaluate new disks that repair the errors in the original. I will check them out and, should this correct the problems, I will let you know my opinions. The industry

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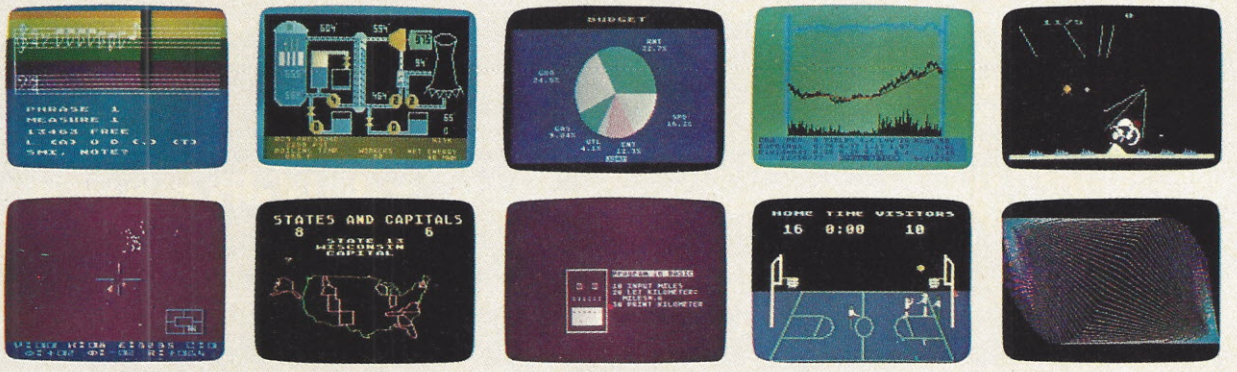

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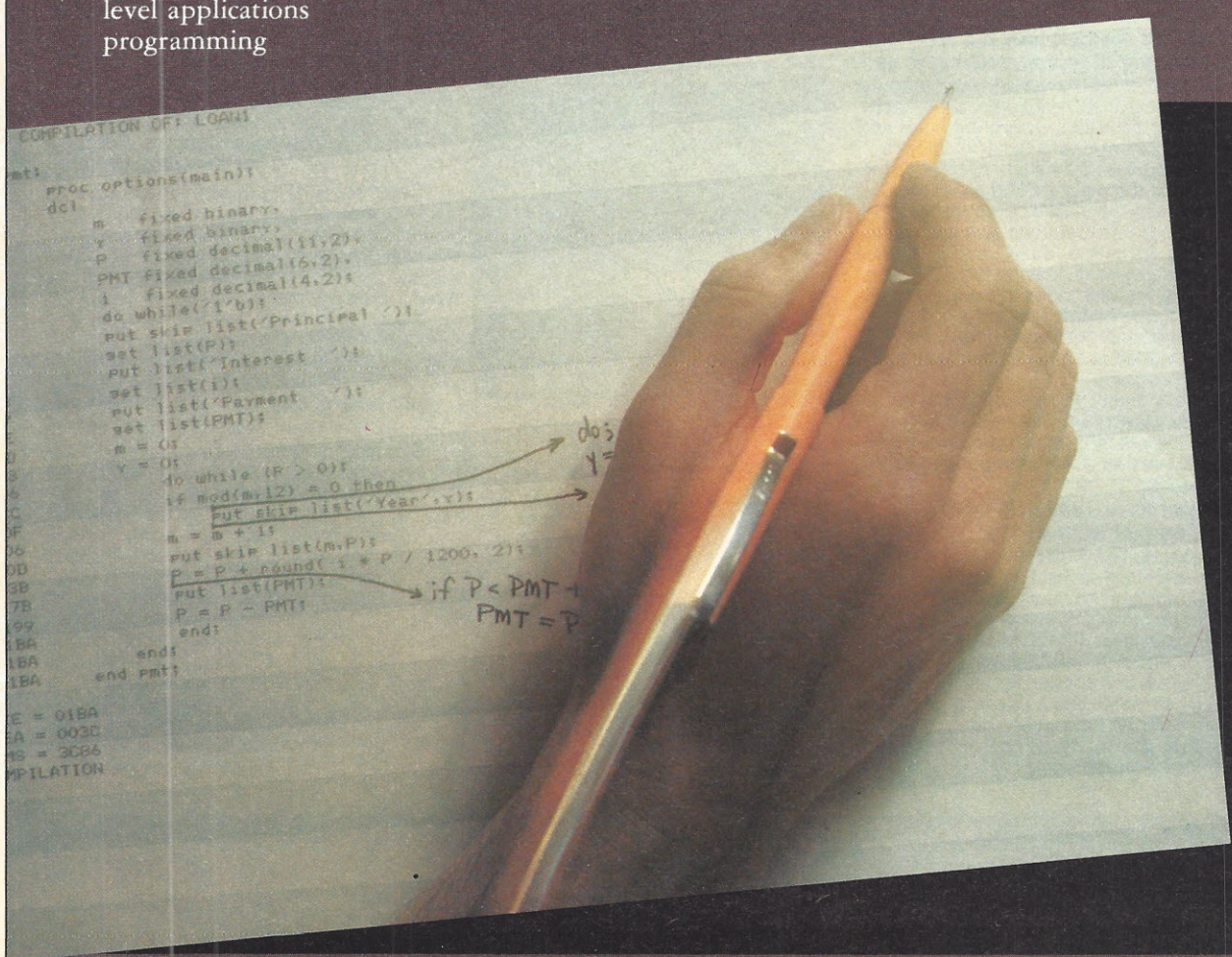

CIRCLE INQUIRY NO. 28

certainly needs good, inexpensive software packages. Should this turn out to be one, I would say the distributor deserves the opportunity to supply them.

Robert Kowitt
E. Meadow, NY

I would like to warn your readers about a company that takes your money for advertised software, then does not deliver the program and does not answer any inquiries about the transaction. The name of the company is: Computer Games, 511 Iowa Ave., Iowa City, IA 52240.

You would be doing your readers a service if you established a column in which the readers can inform each other of the problems we are having with vendors of computer goods and services.

I realize that this might not set well with your advertisers, but someone should provide us, the consumer, with a formal forum. We are being ripped off by non-existent products, products that are sold but are not even in production, bad products, software we can't back up, and software we can't get a back-up of without a loss of time and money. We need equal time.

Bob Brown
Garden Grove, CA

After several attempts to contact Computer Games, Iowa City, IA, we have been unable to verify that the company exists.

We are still receiving many letters in response to our recent request for consumers to voice their experiences (good or bad) in after-sale product support. We will continue to publish the most interesting ones. On page 81 of this issue, we offer a detailed questionnaire that is an even better opportunity for readers to share their experiences. It will be beneficial to all readers if this questionnaire meets with an enthusiastic response, so that we may share the results in a future article.

—LS

Company response to reader complaint

In the January 82 issue of *I.A.*, a letter appeared regarding Rainbow Computing's service. The author of the letter, Richard Brandshaft, also wrote to the Attorney General, State of California. The following is Rainbow's response to the Attorney General.

"On August 4, 1981, Mr. Brandshaft brought his Apple computer into Rainbow Computing, for repair, accompanied with a description of the problem. Two Rainbow technicians worked on the machine over a two-day period trying to duplicate the problem. All available diagnostics were performed on the machine including overnight testing. However, Mr. Brandshaft's machine worked flawlessly.

Mr. Brandshaft was notified on August 5 that no problem was found with his machine. When he came to pick it up on August 6, he was requested to demonstrate the problem. To this he replied that he did not wish to spend any time duplicating the problem. We wanted to show Mr. Brandshaft the working machine, but again he did not wish to see it. Even though Apple's service policy suggests a $40 charge (what Apple charges its service centers when they submit an item for service with a "no problem found" result), Mr. Brandshaft was only charged $25—a minimal charge considering two technicians spent about four man-hours on the problem. Mr. Brandshaft questioned the technician about the charge. The technician replied it was standard policy and stated that if Mr. Brandshaft duplicated the problem, his money would be refunded. Mr. Brandshaft was also shown the Apple service policy. Even though Mr. Brandshaft's machine was under extended warranty, the policy suggests a charge for "no problem found," and it also states that it is the customers responsibility to demonstrate the problem.

Mr. Brandshaft paid the $25 charge without requesting to discuss the problem with management."

It should be noted that the Attorney General has seen fit to drop the issue, deciding that Rainbow Computing followed proper and reasonable business practices.

Glenn Dollar
Rainbow Computing
Northridge, CA

Backward cruncher

I found your recent series by Tom Fox on the prime number benchmark very interesting, despite the fact that it is a very crude test of relative performance. The point of the benchmark, of course, is to compare the speed at which different machines can execute the same set of instructions.

An alternative would be to see how fast the *task* can be executed, and in

LETTERS

this case the manner in which the solution is formulated becomes critical. Having discovered that a compiler Basic gives about a 50% speed improvement, and a 16-bit machine about the same, I decided to examine if the program could be improved.

By far the greatest increase came when the problem was turned completely upside down. Instead of finding the prime numbers, it is quicker to search for the numbers that are not prime. The program to do this is listed here. For a particular machine, the speed improvement was over 96% (1,000 seconds to 35 seconds).

```
 10 PRINT"Starting."
 20 DEFINT A-Z
 30 DIM A(1000)
 40 FOR I=2 TO 500
 50 FOR J=2 TO 32
 60 IF I*J>1000 GOTO 90
 70 A(I*J)=1
 80 NEXT J
 90 NEXT I
100 FOR I=1 TO 1000
110 IF A(I)=0 THEN PRINT I;
120 NEXT I
130 PRINT "Finished."
```

Although the problem is trivial, the exercise emphasizes the importance of the approach adopted - a fairly simple revision of basic ideas did more than a compiler or 16 bits could do.

Jeff Richards
Queensland, Australia

SHOW must go on

Perhaps you can devise a subroutine for your SHOW program (IA Nov 80) to screen out word processing control characters, making it possible to use the program to display w/p document files while running outside the w/p program. I'm looking forward to more of this sort of software in future issues.

James Barber
Naples, FL

Time for liberation

We have a Heath H89 computer and have just purchased a Heath/Zenith Cobol-80 software package. Not knowing very much about computers in general and Cobol specifically, I am doing quite a bit of floundering.

My husband is the computer expert but often talks above my head and I would like very much to develop my own resources and learn independently, as I have a tendency to rely on him for quick answers.

My request is for articles in your magazine about H89 in general and Cobol specifically.

You seem to write about every other system and mostly about Basic programming.

Toni Kellicutt
Half Moon Bay, CA

For our review on the Heath H89, see "System of the Month" (IA Aug 80). We are considering an introductory Cobol tutorial for a future issue.

—LS

Alternative solution

Re: "Inventor's Sketchpad" (IA Jul 81), which discussed control of disabled or artificial legs.

On the off-chance that you have not considered this, it seems that the technology that developed "manipulators" for handling hazardous materials and for working in extreme environments would be directly applicable to this problem.

Keith C. Campbell
Westminster, CA

Bunsen burner benchmarks

We were pleased to read Alan Miller's review of the Supersoft SSS Fortran Compiler (IA Dec 81). However, we take serious issue with the benchmark comparing Microsoft's Fortran-80 to our SSS Fortran. The comparison involved a program that merely computed J = J + 1 about ¼ million times. I like to call such programs "Bunsen Burner Benchmarks" since their only conceivable application is to use the mirocomputer as a heating device. It is undeniable that SSS Fortran performs poorly in such circumstances, since we generate interpretive code. However, our speed becomes competitive in realistic floating point or list processing tasks, and is often superior in double precision calculations, interactive tasks, and disk I/O-bound tasks. Of course, no comparison can be made for complex arithmetic, since Fortran-80 does not support type COMPLEX. It is especially noteworthy that we provide math functions, character string manipulation, bit manipulation, dynamic storage allocation, linked list handling, and direct-access disk I/O.

M. Dennis Mickunas, Ph.D.
Small Systems Services Corp.
Champaign, IL

Plunge right in

"Computer Purchase: Wade in Easy" by Lou and Annette Hinshaw (IA Oct 81) recommends a very low-level approach to the small businessman contemplating computerization. The benefits that the article attributes to this approach are greater understanding, lower system cost, improved performance, the potential for process measurement and control, and the avoidance of unused capacity in the final system. Being both a computer hobbyist and a commercial programmer, I would like to share my reaction with your readers.

The "secrets of how stacks, loops, and input-output processes work" are, I agree, fascinating. I wish the authors every success in making a dot move across their TV screen. Their thirst for understanding is laudable. Their eagerness must strike a responsive chord in many of us readers. However, it is a long way from these things to a business computer. If they proceed on this path and if they put even a modest value on their time, the system will not cost far less than an analogous turnkey package. Meanwhile, the business gets along without the benefits of computerization.

LETTERS

To have a computer with unused facilities or unused capacity seems to me to be not a very serious problem and possibly no problem at all. On the other hand, to have a system that can be maintained only by a few people in the business could be very serious indeed: employees move on, owners become busy looking after the big boom that's just around the corner, and we are all subject to illness and death. A sufficiently big boom, to take the pleasantest possibility, makes the hourly rate for major extensions negligible, but could the business live with the delay? What will it use in the meantime? In short, I believe that to invest in a system merely adequate for current needs is to be "penny wise and pound foolish."

The authors may be forgiven, or even congratulated for their enthusiasm. Your magazine, however, has done a disservice to any naive businessman who read this article.

Terrence Enger
Ontario, Canada

Mr. Enger does not seem to have read the article we wrote. We do not oppose buying a turnkey system, nor do we recommend substituting the "hobby" approach for buying immediately-needed computerization. Our contention is that by adopting computers as a hobby that can be pursued in leisure (not business) time, the small businessman who cannot afford a wrong choice among the myriad computer systems becoming available can learn enough to make an informed choice. Since some of these proliferating systems have serious deficiencies or even bugs in them, this is not an insignificant question. Our point is that one can prepare in spare time for a future need.

Incidentally, we did get the dot to move across the screen.

—AH

Lack of support

Re: "Assignment: Benchmark" (IA Dec 81), let me tell you about Ohio Scientific's "support" for the C-3. I spent two years trying to find out why our C-3 wouldn't accept RS-232 input. The local rep was mystified, while OSI-Aurora had already bluntly revealed to me its policy of refusing to speak to end users. With help form a non-OSI source, I found that the problem was an error in the operating system code that caused the machine to crash upon an INPUT call. OSI was, of course, fully aware of the error, and could have saved me a great deal of time and trouble by merely accepting reasonable responsibility for the machines and software. Perhaps M/A-COM is changing this policy, but it's too late for us; OSI was not even considered for the three computers I've bought since the C-3 fiasco.

Jack McKay, Ph.D
Washington, D.C.

Reader interface

With the acquisition of an Apple II Plus computer this Fall, Science education has taken a new direction at our high school. Chemistry students practice writing formulas and equations. They study the periodic table and account for energy changes between atoms. They review for tests and check their knowledge with immediate confirmation. They learn the ways of atoms and electrons through animation and simulation graphics.

We would like to share programs for drills, graphics, and simulations—anything useful for Chemistry class.

Judy Toop
Auburn Adventist Academy
Auburn, WA 98002

I have a problem that I hope you or your readers can help me solve.

I am looking for information regarding using my TRS-80 as a TTY terminal and answering machine. I am profoundly hard of hearing, and like other hearing-impaired and deaf people, use a TTY for telephone communications.

In California, telephone companies must provide free TTY devices to all qualifying individuals, and I am able to take advantage of this law. However, answering machines for TTY are very expensive. Since I already have a TRS-80, I would like to use it to serve these functions.

Pacific Telephone has been less than helpful when I have inquired about interfacing my computer to TTY. They told me that information such as baud rate, modem frequencies and the Baudot coding was proprietary information! And so far, I have not found the answer to my problem in the microcomputer magazines.

According to the U.S. Government, there are nearly 20 million people in this country with hearing disabilities, of which only 2 million are considered "deaf." However, even people with moderate hearing losses have difficulty with the telephone, and the market for a device or program that allows the use of a personal computer as a TTY device would appear to be a large one.

Dick Burkhalter
Diverse Developments
2203 W. Olive Ave.
Burbank, CA 91506

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UPDATE

Software supermarket offers unique retailing approach

A recently opened retail store in Los Angeles, CA, offers a unique concept in consumer software marketing.

The Software Store was designed to provide counseling and information to help business people, families and professionals stay in touch with the latest technology.

This store carries a complete selection of personal and business CP/M computer programs, magazines, books and games. Prior to this venture, there was no central location to shop for all brands of computer programs or see them demonstrated on various computers for comparison.

"The theory behind the store is to select whichever business or personal microcomputer software best fits business or personal needs; then locate the right microcomputer and components (hardware) to do the job," according to the store's founder, Glenn Johnson (pictured here). "The store should be thought of and used in the same context as record and video stores."

Johnson cemented the idea for the store after he saw two of his friends become millionaires from a mail-order software business that they started in a garage. Now considered an entrepreneur

in the computer field because of the overnight success of The Software Store, Johnson is planning satellite stores in the near future.

Seminars and classes are being scheduled to further instruct present and potential small computer owners how to apply the software programs successfully and to explore future needs, such as business and home management, word processing and education for children.

Apple announces anti-mail order policy

Apple Computer, Cupertino, CA, recently announced a policy in response to problems presented by the impact of mail order product sales.

According to A.C. Markkula, Jr., Apple president and chief executive officer, all authorized Apple dealers are now required to sign contract modifications in which they agree not to engage in mail order sales of Apple products.

"Mail order sales are neither suited to providing consumer education nor structured to provide consumer satisfaction," said Markkula. He indicated that this was an action taken by Apple to insure that sales of its products are properly supported.

Center will teach language and other computer skills

A learning center organized to provide young people with an on-going opportunity to enjoy studying personal computers and computer languages has been opened in Richardson, TX. Organized and operated by the Young Peoples'

Product Highlight: Dynabyte 5505.

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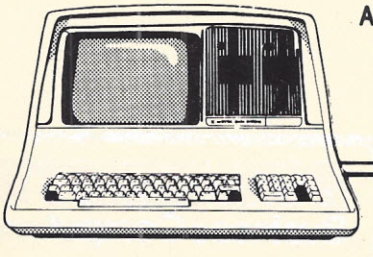

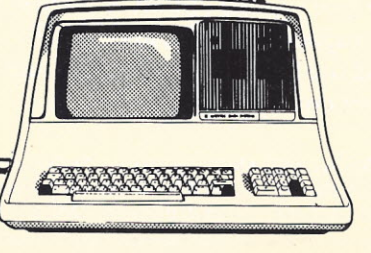

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CIRCLE INQUIRY NO. 12

UPDATE

Logo Association, the Turtle Learning Center will offer on-going individualized instruction in Logo, turtle graphics, Basic, Pilot and other languages appropriate for young people.

For a monthly membership fee, youngsters will be able to spend a Saturday afternoon learning about computer languages. They will also gain experience with peripherals, networking, telecommunications, and the fun aspects of working with a computer.

"We're starting in a garage with about a dozen systems and about two dozen youngsters," stated Jim Muller, YPLA president. "However, our plans call for the eventual opening of other Turtle Learning Centers around the country as our new organization gains momentum."

Semiconductor documentary highlights Japanese challenge

Charles E. Sporck, president of National Semiconductor Corp. recently told a select group of employees, "We're at war with Japan; not with guns and ammunition, but an economic war with technology, productivity and quality."

To bring that message to the company's employees, a new film, *On the Line,* is a revealing 37-minute documentary focusing on the competitive challenge facing the American semiconductor industry in the 80s. Produced and directed by King Arthur Productions, the film was made possible by a grant from National Semiconductor, Santa Clara, CA.

The film was designed so that employees could heighten their awareness of the Japanese challenge in order to prepare them for the next steps in reaching productivity and quality goals. The film won first place in the Employee Information category at the San Francisco Film Festival, and also won the Cine Golden Eagle. It will be made available to other American companies, organizations, and network television.

The production team spent two weeks at Bandai, a toy factory outside of Tokyo, to observe firsthand the daily on-the-job routines of their Japanese counterparts and share after-work hours learning about their families and culture. None of the four had pre-set impressions of the country they would visit.

"They are more motivated than we are," said Clover Bechtold, PMUS specialist and team member. "Somewhere along the line, we've gotten fat and lazy. It's a race between a tortoise and a hare. We've been the hare for so long, we thought nobody could catch up —but they have."

Local area network study finds industry not ready to standardize

Ethernet, the Xerox local area network company that is attempting to set the industry standard, has limited growth potential, according to a local area networks study just released by Venture Development Corp., Wellesley, MA.

The report indicates that the local area networks market will reach the $1 billion per year level by 1990, making it one of the major growth areas in the electronics industry. According to the report, this emerging market might develop along any of three courses. First, there is the scenario in which a dominant low-cost system becomes standard and captures most of the market; further technological development would then tend to be stifled. Ethernet is attempting to set this stand-

Fill this space with a GRAFTRAX graphic and win a trip to Japan.

The Epson "Softwear" Sweepstakes.

We're looking for the Picasso of programming. So we drew up an art contest for people who don't know a painting pallet from a PROM.

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All you have to do is program a GRAFTRAX graphic — abstract, landscape, still life, whatever — using an Epson MX-70, MX-80, MX-80 F/T or MX-100 printer. We'll not only put it on our T-shirts, we'll be displaying the winning entries for all to see in June at the National Computer Conference in Houston.

Why, you may ask, are we being so generous? It's simply because GRAFTRAX is the most incredible graphics capability made for micros. And we want to see it used to its full potential.

All entries will be judged on originality, creativity and best use of computer equipment. They must be postmarked no later than May 1, 1982, and be accompanied by the software program, so we can recreate the winning entries for verification. Make sure the graphic is no larger than 8" x 10" and no smaller than 4" x 6". And remember, if you digitize art or a photograph, it must have been originally created by you.

So get busy and enter. You might be a winner.

And your software could be your "softwear."

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ard. VDC thinks success is improbable; the system is somewhat primitive.

A second, more probable, scenario, predicts a technological jungle in which the marketplace is filled with different, innovative products, each fighting for its share on the basis of improved price-performance ratios. A dominant design will emerge after a shakeout.

A third possibility is that computer and office automation companies will use local networks as a competitive weapon to sell their own computer or office automation systems. Each local area network system would be incompatible with every other, so that a system user would be locked into a particular vendor's hardware (computers, terminals, word processors, printers, etc.). This, VDC believes, is an irrational scenario that will hold back the development of local area networks and retard market penetration.

Computers help New Hampshire police catch up with criminals

The State Police of New Hampshire are using a computer system to gather information on known and suspected criminals of all kinds, making it easier to apprehend car thieves, burglars, murderers and fugitives that enter New Hampshire.

To compile the names, dates, vehicle IDs, and other necessary data, the Honeywell Level 6/33 system communicates with computers located at other New Hampshire State departments, with national "crime watch" data centers, as well as other states' police computers.

Within New Hampshire, the computer communicates with a Honeywell DPS 8/52 large-scale system at the state's central data-processing center, which includes records on all motor vehicles registered in the state, along with accident reports and traffic violations by New Hampshire motorists.

In addition, the system shares data files with a Sperry Univac system at the Highway Department, which contains data on all New Hampshire drivers' licenses. The system also communicates with the IBM controller at the National Crime Information Center in Washington, D.C.

Another communications line links the Level 6 to a Digital Equipment Corporation computer in Phoenix that controls the National Law Enforcement Telecommunications System.

Technical Sgt. Fred Booth of the State Police says that the data received from the switching system provides such information as the name of a vehicle's registered owner, his date of birth, legal information as the name of a vehicle's license plate number and expiration date, plus make, model, style, weight, and number of cylinders.

The small computer also maintains backup files of all state NCIC data, should regular communication lines fail or become tied up with other traffic. In addition, the application software (written for the system by Computer Projects, Inc., Greensboro, N.C.) is unique in that a single keystroke on one of the video terminals can query many computers simultaneously.

The system supports 21 onsite or remote communications lines, has a combined main memory of 256K bytes, 104M bytes of formatted disk storage, one 800/1600-ips dual-density tape drive, six printers, and 10 Honeywell VIP7801 video terminals.

New software enables programming of Asian characters

An important software breakthrough, Asiagraphics, is a program that enables people using Asian languages to utilize computer technology with the same ease and efficiency as users of Western languages.

A specific character from the many thousands in the Asian languages may be selected by typing a unique code on a standard typewriter keyboard; the characters is displayed on a video screen. Both traditional and simplified characters are available. The unique code, called a descriptor, consists of two elements: (1) the phonetic representation of the pronounciation of the character—in either Pinuin or Bo Po Mo Fo for Chinese, either Katakana or Romanji for Japanese; and (2) a phonetic rendering of the radical family to which the character belongs.

At present, there are descriptors for more than 6,600 characters in the computer memory (with associated graphic data to draw and display more than 4,800 characters). Both the phonetic and graphic inventory can be expanded to include more than 15,000 characters. New characters may be entered into the inventory at any time, even in the midst of text entry, using a new-character generator program.

GAME CORNER

by Patrick and Leah O'Connor

The Zebra Problem

Some weeks ago, the teacher in a course I (Patrick) am taking brought a problem for our class to solve. The object was for one group of students to observe the others' methods of working together to solve the problem, but the problem *in itself* proved interesting. Looking at it, I had the idea for a computer program, and a general computer method for solving problems like the one that follows.

There are five houses, each of a different color and inhabited by men of different nationalities, with different pets, drinks and cigarettes. By whatever process you can devise, find out *who drinks water* and *who owns the zebra.*

1) The Englishman lives in the red house
2) The Spaniard owns the dog.
3) Coffee is drunk in the green house.
4) The Ukranian drinks tea.
5) The green house is immediately to the right (your right) of the ivory house.
6) The Old Gold smoker owns snails.
7) Kools are smoked in the yellow house.
8) Milk is drunk in the middle house.
9) The Norwegian lives in the leftmost house.
10) The man who smokes Chesterfields lives in the house next to the man with the fox.
11) Kools are smoked in the house next to the house where the horse is kept.
12) The Lucky Strike smoker drinks orange juice.
13) The Japanese smokes Parliaments.
14) The Norwegian lives next to the blue house.

It appeared to me that the problem could be solved by a human more easily than by a computer, given the superior pattern-recognition ability of the human brain. In other words, I could probably solve the problem more easily than write a program to solve it. Nevertheless, fools rush in where angels fear to tread, and I barged ahead with plans to solve this problem by computer-program. My starting point was an array of names, colors, cigarette brands, drinks and pets (figure 1).

I decided on a strategy of shuffling the items around on each row, until they'd been shuffled around in all possible permutations, then checking the resulting array after each shuffle step to see if it satisfied all the requirements. I knew that all the computer would have to rearrange were the items on each line. All the arrangements of nationalities, for example, would be tried if the top line were shuffled around. Each of those arrangements would be left in place while all the arrangements of colors were tried; the colors would not be rearranged until all the arrangements of cigarette brands were tried; the cigarette-brand arrangement would only change after every drink arrangement was tried; and the drinks would be rearranged every time all the arrangements of pets had been run-through.

ARRAY A$(I,J)

A$(0,0) Norwegian	A$(0,1) Ukranian	A$(0,2) Englishman	A$(0,3) Spaniard	A$(0,4) Japanese
A$(1,0) Yellow	A$(1,1) Blue	A$(1,2) Red	A$(1,3) Ivory	A$(1,4) Green
A$(2,0) Kools	A$(2,1) Chesterfields	A$(2,2) Old Golds	A$(2,3) Luckies	A$(2,4) Parliaments
A$(3,0) WATER	A$(3,1) Tea	A$(3,2) Milk	A$(3,3) Orange J.	A$(3,4) Coffee
A$(4,0) Fox	A$(4,1) Horse	A$(4,2) Snails	A$(4,3) Dog	A$(4,4) ZEBRA

Figure 1. Arranging arrays

A pretty nasty bunch of nested loops. I thought so, too, and decided to handle that after I figured out how all the rearrangements of a line would look. How many permutations are there for five things like these? Each item appears only once on a line, and there are always five different things, taken five at a time, on each line. According to the rules of statistics, five things taken five at a time vary in 5! (5-factorial) ways; that is, 120 different arrangements of pets, for example.

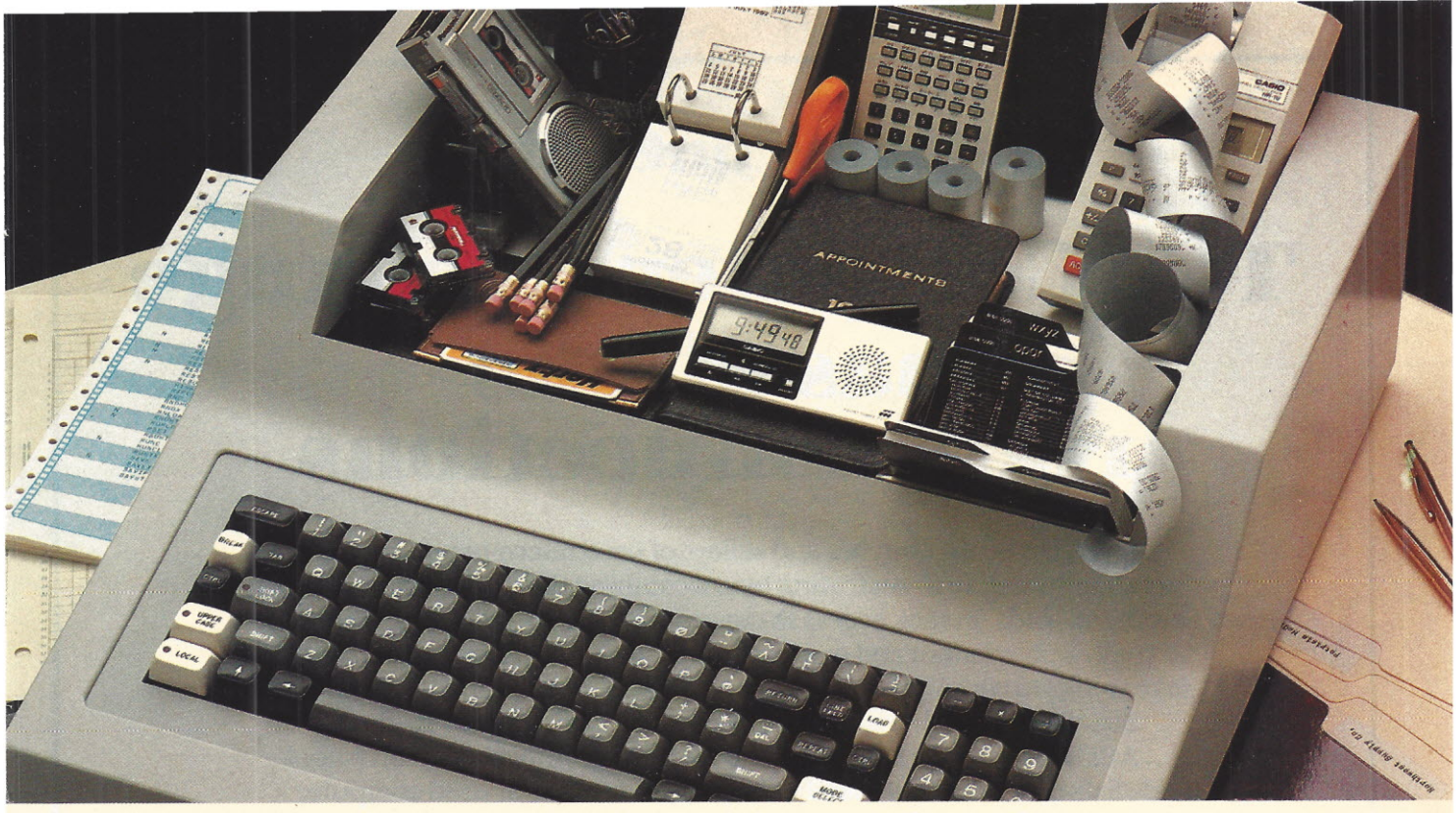
To simplify the arrangement scheme, I chose to represent the things on each line symbolically. A given line could be represented by:

a b c d e

in its "un-permuted" starting condition. After the first rearrangement, it would look like this:

a b c e d

All 120 permutations would look like the arrangement in figure 2. It occurred to me that the symbols should be numbers



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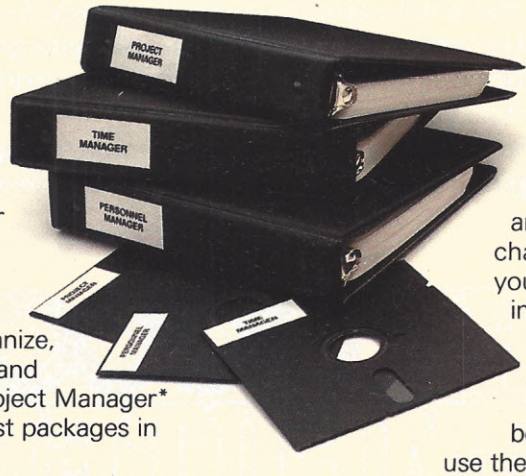

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abedc	aebdc	aedbc	aedcb
bacde	bcade	bcdae	bcdea
baced	bcaed	bcead	bceda
badce	bdace	bdcae	bdcea
badec	bdaec	bdeac	bdeca
baecd	beacd	becad	becda
baedc	beadc	bedac	bedca
cabde	cbade	cbdae	cbdea
cabed	cbaed	cbead	cbeda
cadbe	cdabe	cdbae	cdbea
cadeb	cdaeb	cdeab	cdeba
caebd	ceabd	cebad	cebda
caedb	ceadb	cedab	cedba
dabce	dbace	dbcae	dbcea
dabec	dbaec	dbeac	dbeca
dacbe	dcabe	dcbae	dcbea
daceb	dcaeb	dceab	dceba
daebc	deabc	debac	debca
daecb	deacb	decab	decba
eabcd	ebacd	ebcad	ebcda
eabdc	ebadc	ebdac	ebdca
eacbd	ecabd	ecbad	ecbda
eacdb	ecadb	ecdab	ecdba
eadbc	edabc	edbac	edbca
eadcb	edacb	edcab	edcba

Figure 2. 120 permutations

instead of letters, so they could be used as subscripts in the array-shuffling procedure. This means that there must be a program to generate the numbers in figure 3.

The easiest way to handle generating this table of numbers would be to store them as-is. That takes up a lot of memory, but makes easy programming. The entire table could also be generated from scratch. Somewhere in between the two extremes there is a compromise; you can get the table by storing a part of the table as an array, and permuting its rows and columns, as in listing 1.

In this form, the array of 0,1,2,3,4's is printed out, not used as subscripts for the alphanumeric array. I also wrote a version of this program where the array was stored totally as a 120 by 5 matrix. To use each "0,1,2,3,4" number-array to reshuffle the words on a line, I decided to generate a second array, B$(I,J):

```
DIM B$(4,4)
FOR J = 0 TO 4
FOR I = 0 TO 4
B$(I,J) = A$(I,J)
NEXT I,J
```

...which would be a 'clone' of "A$" until the program calls a subroutine to rearrange a row:

```
FOR J = 0 TO 4
B$(I,J) = A$(I, COL(H,J))
NEXT J
' SHUFFLE ITEMS ON A ROW ACCORING TO COL(H,J)
RETURN
```

This routine, called from somewhere in the main program, would take any line generated by the 0, 1, 2, 3, 4, permuter described earlier, and use it to shuffle row "H" of the "A$" array. By calling this routine inside the right set of nested loops, all the variations of the "zebra array" would be generated.

Now for the "B.S. filter" part of the program. Most of the arrays generated will be "B.S." Each permutation will have to

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be checked against a series of IF statements that test for conditions like "the Norwegian lives in the leftmost house"—

IF B$(0,J) = "Norwegian" THEN...

In fact, that's why I set up the "A$" array with the Norwegian in the A$(0,0) position. When all the other rows are permuted, the topmost row is last, and the scheme of permutations try FIRST those arrangements that have the "0" element at the left edge. This would cut down the number of tests made by 80%, since only 20% of the possible "B$" permutations have the Norwegian on the left.

Now, it might have occurred to you to look at the "A$" array we set up and check it out to see if it solves the zebra

01234	02134	02314	02341
01243	02143	02413	02431
01324	03124	03214	03241
01342	03142	03412	03421
01423	04123	04213	04231
01432	04132	04312	04321
10234	12034	12304	12340
10243	12043	12403	12430
10324	13024	13204	13240
10342	13042	13402	13420
10423	14023	14203	14230
10432	14032	14302	14320
20134	21034	21304	21340
20143	21043	21403	21430
20314	23014	23104	23140
20341	23041	23401	23410
20413	24013	24103	24130
20431	24031	24301	24310
30124	31024	31204	31240
30142	31042	31402	31420
30214	32014	32104	32140
30241	32041	32401	32410
30412	34012	34102	34120
30421	34021	34201	34210
40123	41023	41203	41230
40132	41032	41302	41320
40213	42013	42103	42130
40231	42031	42301	42310
40312	43012	43102	43120
40321	43021	43201	43210

Figure 3. Numerical assignments of permutations

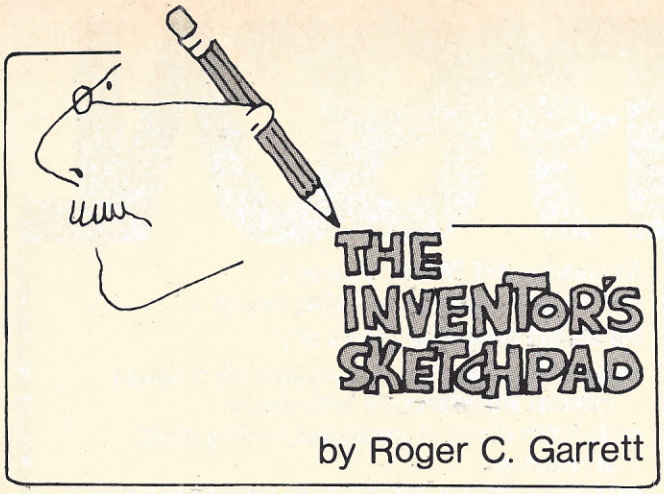
problem the way it is. The array listed for "A$" is *already* the solution to the zebra problem!

But, is it a *unique* solution? Are there other patterns that also solve the conditions described, with the zebra and water in the same place?

I guess you're going to have to finish the program to find out. I'll give you a hint, though—there are 120 different versions of each row, and five rows, which means the number of variations that *might* be generated are 120, to the 5th power. That is a little over 24 billion combinations. If your micro could test each permuted array using all the IF statements in a second, that would take 788-and-a-half years, nonstop (not counting power-outages). By only doing the first 24 permutations of the top row (the ones that have the Norwegian on the extreme left), we cut out 80% of the computation (that takes just 157-and-three-quarters years) to test all the combinations on the other rows.

So here's my challenge. Do any readers know a shorter way to solve this problem with a computer program? Send your ideas to me, and I'll publish the best one. Good Hunting, and bring that zebra back alive. □

Program on page 140



Magnetic Liquid Display

Some time ago, when magnetic tape was still the preferred method of data storage, an enterprising company developed a product for reading damaged tapes. As I recall, it consisted of a brush, a supply of magnetic fluid—a liquid base containing a powder of microscopic, magnetically dipole crystals in suspension. When you brushed this fluid over the surface of your mag tape, the magnetic crystals would be attracted to the magnetic regions on the tape, leaving a droplet of fluid at each "on" bit and allowing the user to read the tape by noting the positions of the drops (figure 1). I found the idea humorous at best, and wonder whether many people actually made use

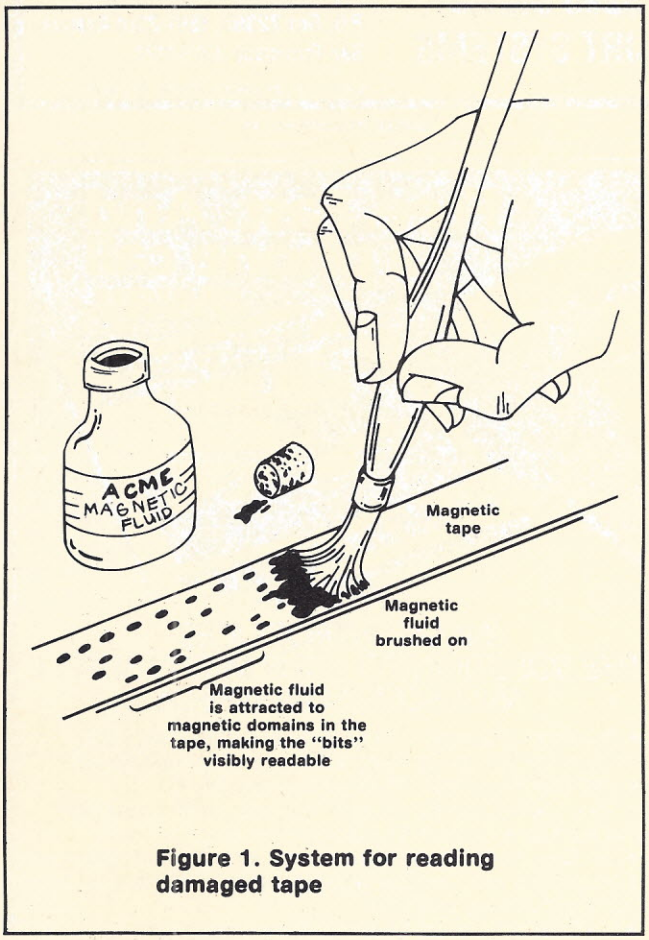


Figure 1. System for reading damaged tape

of the product. Imagine some programmer smearing this liquid over a 600-ft. reel of tape to find a dropped bit.

Recently, I received a note from a friend concerning an idea he had for a pocket-size device requiring a high-resolution flat panel display. The technology necessary for his overall concept unfortunately does not yet exist, but it set me to thinking. Perhaps some use could be made of that magnetic fluid approach to making magnetic domains visible.

What I propose is to combine magnetic fluid and liquid crystal technologies to produce a liquid that, (under the influence of a magnetic field) aligns all of its crystals so that light passes freely through it, just as transmissive LCDs do under the influence of an electric current. It also would block light in the absence of that magnetic field by the random orientation of its crystals.

My basic scheme is shown in figure 2. The magnetic crystal fluid is micro-encapsulated in clear plastic spheres, which are then embedded within a clear plastic base to form the viewing

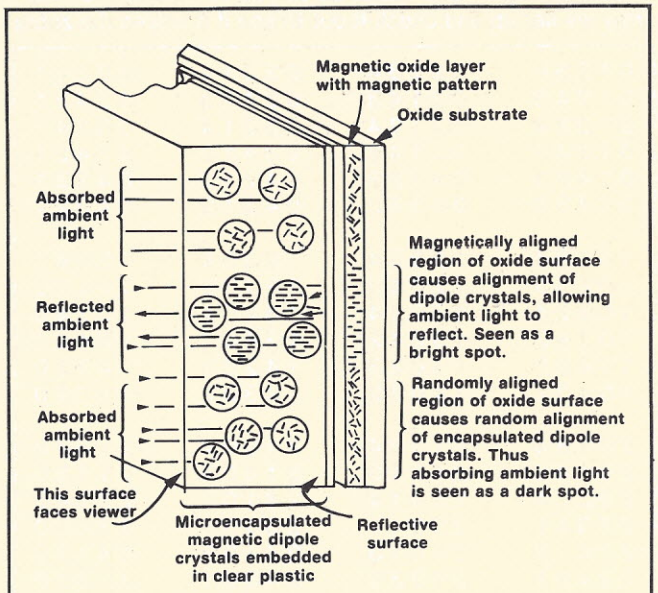


Figure 2. Micro-encapsulation of fluids to form viewing screen

screen. In most LCD applications, the liquid crystal is placed between two sheets of glass or plastic and sealed at the edges, but such an approach is highly susceptible to contamination and difficult to manufacture. By locking the liquid in tiny plastic beads, it should eliminate contamination problems and make the manufacturing process as simple as mixing the beads with an epoxy-resin type plastic and injecting it into a mold.

The back surface of the viewing plate is coated with a highly reflective layer. Behind the plate, we place a separate plate or tape that has a magnetic oxide coating, capable of holding a pattern of magnetic domains, in the same manner that a magnetic tape or floppy disk holds "bits." Assuming we have somehow placed a pattern on the magnetic plate, each area where the plate is magnetized will cause the magnetic crystals inside the adjacent spheres to line up. The ambient room light will pass freely through this section of the viewing plate, bounce off the reflective surface, and emerge from the plate, resulting in a bright spot at that position. Non-magnetized areas of the magnetic plate result in randomly oriented crystals in the spheres, no light transmission, and a dark spot on the viewing plate. While such a device could be used to read binary data from a magnetic media simply by placing the viewing plate over the tape or floppy diskette, the more intriguing application is in displaying text and graphics.

Suppose, as in figure 3, that we arrange an array of individually-controlled micro-electromagnets and a magnetic plate that moves past the array behind our viewing plate. Under computer control, the magnetic write-heads are individually activated, "impressing" magnetic domains in the plate. By proper control of these write-heads in conjunction with the steady movement of the plate, we can write a magnetic image on the plate, which is then made visible by the viewing plate.

Figure 4 shows a possible application for this concept, namely a pocket-size electronic newspaper. A magnetic plate

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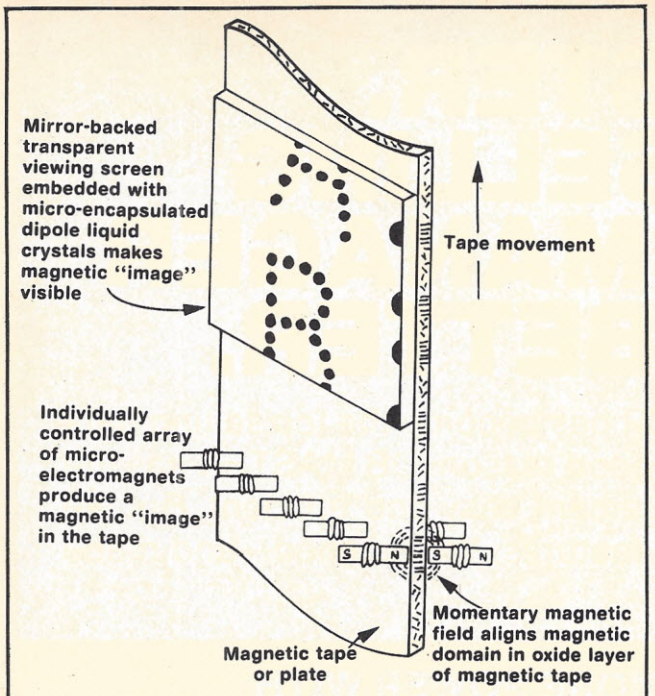

Figure 3. Writing magnetic image on the plate

is used to hold the image. The plate moves down past the write/erase heads to erase the image, then back up to write the new image and make it visible. The user thus gets a page of information at a time. With a sufficiently strong and fast motor, the pages would seem to flick into view, rather than scrolling down and back up.

The illustrations are set up as follows: a) The magnetic plate is in the uppermost viewing position, and part of a newspaper article is displayed. b) The user issues a command for the next "page," perhaps by pressing a key, and the magnetic plate is moved via powered rollers, past the write-heads which are all left activated, thus erasing the "image" from the plate. To the user, if he looks quickly enough, the image seems to scroll downward. c) The plate has been entirely erased and the screen appears momentarily blank. d) The magnetic plate movement reverses and the computer appropriately flicks the magnetic write-heads on and off, to record the new image on the plate as it moves past. The user sees the image scrolling quickly upwards. e) The plate has moved completely upwards and remains there, displaying the recorded image, until the user again hits the "next page" button. The image remains (even if the power is turned off) since the image resides as a set of magnetic domains in the internal plate, and the viewing plate consumes no power.

If a sufficiently strong and flexible magnetic tape were available, an "endless loop" implementation might be feasible (figure 5), in which the images always scroll in the same direction, with new information always coming in from the bottom, as is the case with most computer CRT terminals.

While such a display technology is not suited to applications requiring real-time interactive graphics (such as game animation), it is ideally suited to the broad range of applications requiring relatively static or sequential displays. Games like Chess and Checkers come to mind (figure 6), as well as remote data-entry terminals and data base query systems. When we consider that prior to the introduction of low-cost CRTs, almost all computer applications were done with printers, and that our magnetic display is essentially a printer, we realize that there is a broad range of uses to which it can be put. Its advantages are many: a displayed image remains visible, even

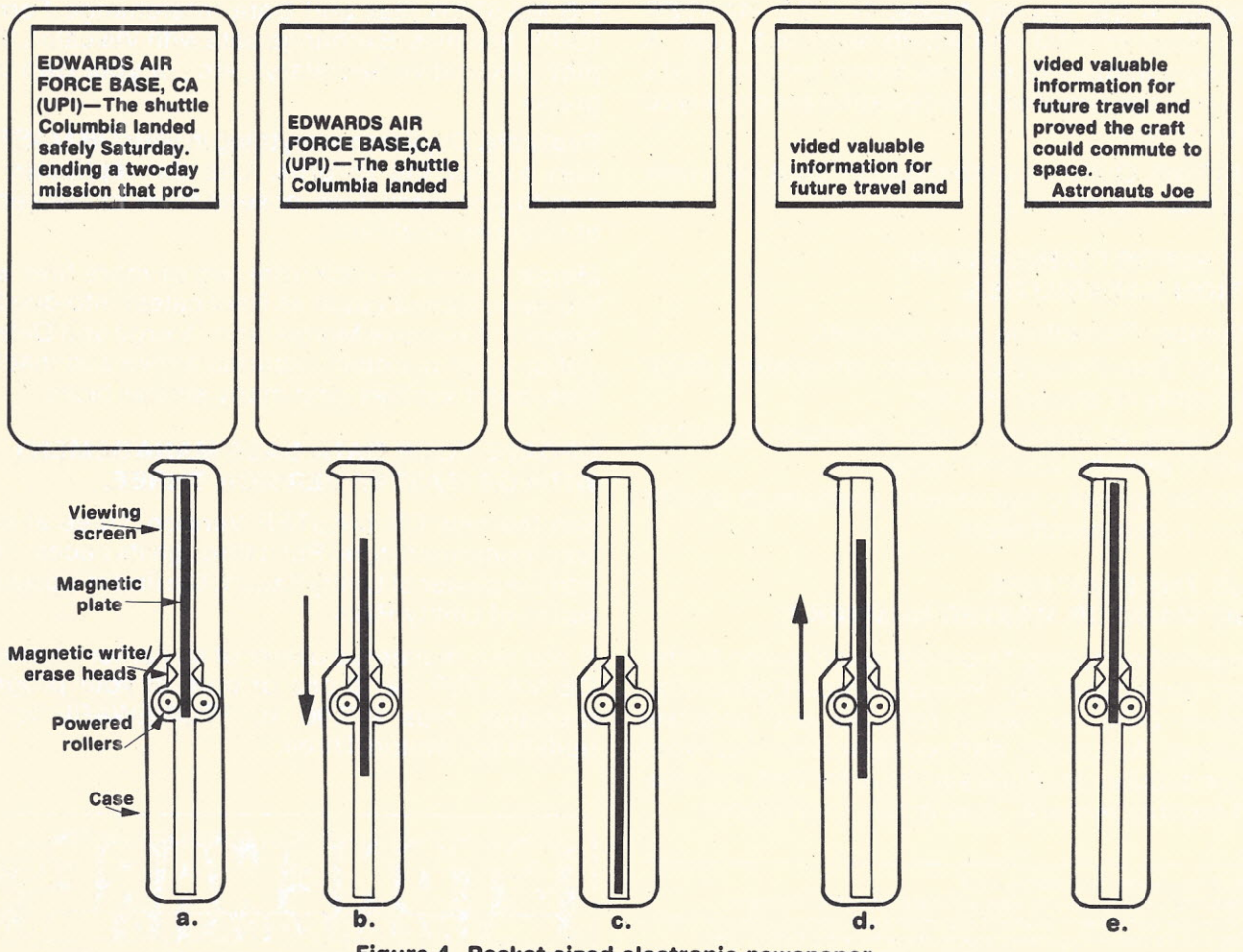

Figure 4. Pocket-sized electronic newspaper

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after the computer is turned off. Although the width of the display is determined by the array of write-heads, and thus affects cost, the height of the display is dependent only upon the height of the viewing plate, a relatively inexpensive part.

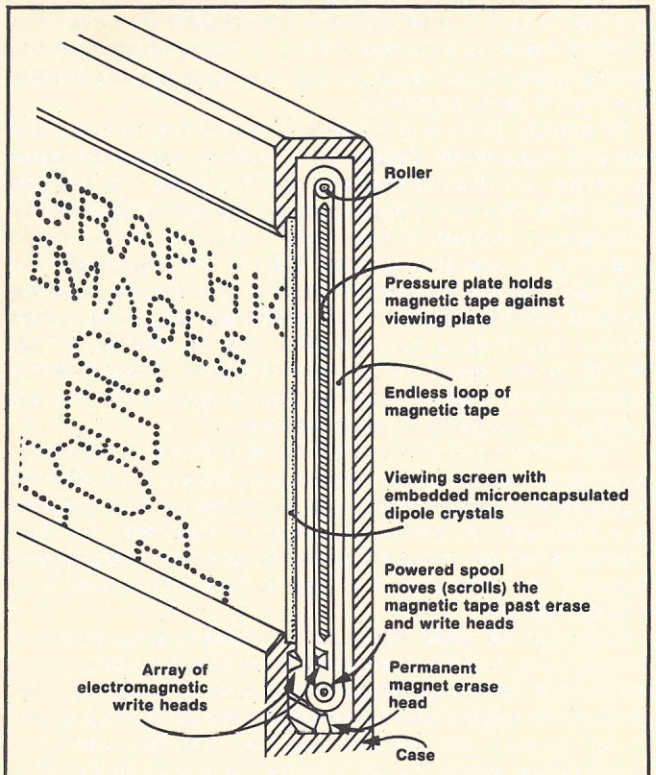


Figure 5. Endless loop implementation

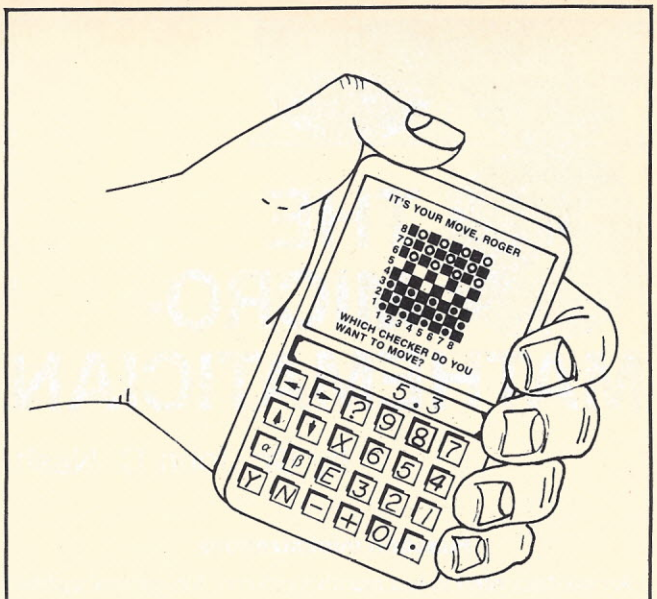
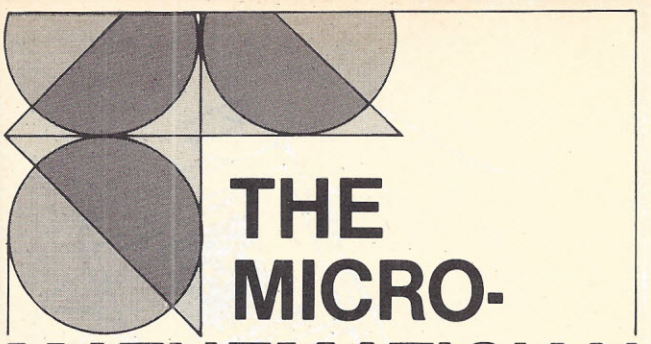


Figure 6. Possibilities of visual output

By turning the device 90°, it could form a long and high-character-width display, even stretching around the room if we had such a need. And the basic technology can even provide for color displays. Next month's column will discuss this aspect.

If you have an idea of how this might be done, drop me a line, care of the magazine. And if you've developed other interesting ideas that you think our readers would enjoy, we'd like to hear them as well. □



THE MICRO-MATHEMATICIAN

by Dr. John C. Nash

Function minimizations

As we discussed in last month's column, the general optimization problem of minimizing or maximizing a function subject to constraints can be reduced to an unconstrained minimization problem by use of penalty or barrier functions. This month we consider a particular method of minimizing a function

$$Z(\mathbf{b}) = Z(b_1, b_2, b_3, \ldots, b_n)$$

of n parameters. This is the Hooke and Jeeves pattern search method, originally described in the Journal of the Assoc. for Computing Machinery in 1961. Since that time, a number of more efficient methods for function minimization have been developed, but the fact that the Hooke and Jeeves method results in a very short program and uses very little working storage makes it quite attractive for use on a small computer. For this reason, I chose it as the method to implement on the Sharp/Radio Shack pocket computer. Using only the 26 named data memories, (a reserved data area of 26 individually addressable numbers that are not part of the program storage memory), the resulting program is capable of minimizing a function of up to seven nonlinear parameters. Moreover, the program takes up only about 40% of the program memory, leaving quite a lot of space for the user code to calculate the function of these parameters.

Of course, there is a trade-off in speed for this very low memory requirement. Readers who wish to implement faster but more complicated methods will find some that are still reasonably short in my book *Compact Numerical Methods for Computers,* Halsted Press, New York. For really tough problems, where the function Z(**b**) is very expensive to calculate and the number of times it is evaluated must be small to avoid bankruptcy or unrealistically long computation times, I recommend the work of P. Gill, W. Murray and M. Wright, whose recent book was referenced in last month's column. Unfortunately, most of their programs are not yet adapted or adaptable to small machines.

The Hooke and Jeeves method is iterative in nature. It requires a starting point $\mathbf{b}_0$, that is, an initial set of parameters from which to begin a search for the minimum. Also required is a step-size, d, and a convergence tolerance, tol. The method works by various heuristic changes to the parameters, reducing the step-size d at appropriate points until it is smaller than tol.

Note that the same step-size is applied to all parameters, so there is an important requirement for scaling. Furthermore, the method never increases the step-size, so a starting point far from the solution may cause a very time-consuming search to be initiated. Occasionally, we may also get premature convergence, where the program halts at a point that is not a good approximation to the minimum, if the particular function Z(**b**) is such that the chosen $\mathbf{b}_0$, d, and tol lead to a very small step-size before the minimum is approached.

Step	Description
AS1	For i=1 to n. *Loop over the axes.*
AS2	Let g=b_i; let b_i=g+d. *Save parameter. Step forward.*
AS3	Compute A=Z(b).
AS4	If A < F then goto step AS9. *Test function at probe point.*
AS5	Let b_i=g-d. *Step backward if forward step unsuccessful.*
AS6	Compute A=Z(b).
AS7	If A < F then goto step AS9.
AS8	Let b_i=g. *Reset parameter is unsuccessful both times.*
	Goto step AS10. *Do not update function value.*
AS9	Let F=A. *Update function value if successful.*
AS10	End of loop on i.
	This is the end of the axial search.

Figure 1. Algorithm AS: Exploratory Axial Search

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```
Step      Description

PM1       For i=1 to n. Loop over the parameters.

PM2           Let g=2*b_i - x_i. The new base point component.

              Let x_i=b_i; let b_i=g. Save current point, new base point.

PM3       End of loop on i.

          This is the end of the pattern move.
```

Figure 2. Algorithm PM: Pattern Move

The Hooke and Jeeves procedure is made up of two kinds of moves in the n-dimensional parameter space. These moves are called Exploratory and Pattern moves. The Exploratory moves are very simple to explain, since they involve changing each parameter in turn by an amount d, the step-size. If each parameter is considered as defining an axis in the n-dimensional space, this is just an axial search.

Assume a given base point **b** = **x** (that is, the parameter values at this point are saved as x_i, i = 1, 2, ..., n) and a function value F = Z(**x**), which is the lowest value so far found. We then carry out a sequence of probing steps in each axial direction, first adding the step-size to the parameter; then, if the function value is not reduced, we subtract the step-size. If the function is lower at one of the probe points, we keep the new value of the parameter, update F to the new lower function value, and try changing the next parameter. This is detailed in figure 1.

At the end of the Exploratory axial search, we make the resulting point or set of parameters **b** a new base point. Note that the new base is the same as the old one if the function values found in the search are all at least as great as that at the point **x**.

The other type of move in the Hooke and Jeeves method uses two base points to generate another and is called a Pattern move because it presumes the overall movement during the Exploratory phase to be in the general direction of the minimum. Therefore, why not consider the jump from the initial base, still saved in **x**, to the new base **b**, and try a similar jump in the same direction from **b**. The equation for such a jump is

$$\mathbf{b}_{new} = \mathbf{b} + (\mathbf{b} - \mathbf{x}) = 2\,\mathbf{b} - \mathbf{x}$$

where the calculations are of course carried out component by component. (APL fans can have a happy time with the Pattern move, but the Exploratory moves are less amenable to operational coding on vectors.) The details of the Pattern move are given in figure 2, where readers will note that the new base point is saved in **b**, while **x** is updated to the latest base point for which a function value is available, that is, the point which was stored in **b** before the pattern move.

It remains to be stated how the Exploratory and Pattern moves, which have been called AS and PM in the figures, are combined into a working function minimizer. An obvious choice for the first base point, **x**, is the initial point $\mathbf{b}_0$, which we have guessed is not too far from the minimum. With

$$F = Z(\mathbf{b}_0) = Z(\mathbf{x})$$

we perform the Exploratory search AS. Supposing that this is successful (finds a lower function value), we then do a Pattern move PM. The Exploratory search is then repeated from the new base. After PM, **x** holds the point with the lowest function value F. Note that the function is *not* evaluated at the new base point, which results from the Pattern jump, now defined by **b**. This may seem an odd oversight, since **b** is the result of a logical extrapolation, but the overall method seems to work better, in the sense that the function Z is evaluated fewer times when one does not bother to try to incorporate a calculation of the function at this point. I have verified this myself on a few test functions. For specific combinations of functions, starting parameters $\mathbf{b}_0$, step-size d and tolerance tol, the modifications may result in quicker convergence, but on the whole, they seem to result in extra work.

The sequence Exploration/Pattern move can be repeated as long as each Exploratory phase AS is successful in lowering the function value. When the procedure AS fails to find a point where the function value is lower, we must take alternative

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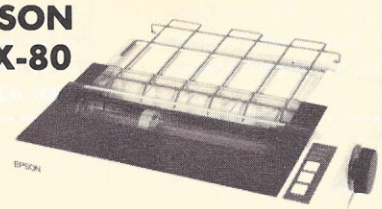

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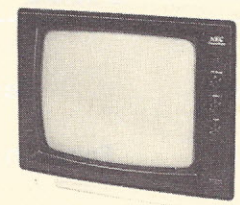

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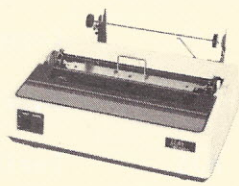

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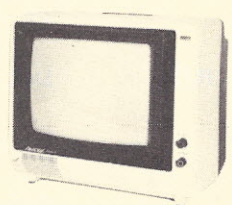

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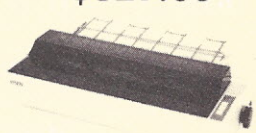

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action. The first thing to check is the possibility that the current base point **b** is *not* the point at which the lowest function value so far was found. That is, F is *not* Z(**b**). In such a case, we can begin the axial search again at **x**, the old base where the lowest function value so far was observed, by simply resetting **b** = **x**. If this is successful, it can be followed by a Pattern move as before.

When the base point **b** is the same as the old base point **x**, which occurs if the first Exploration fails and when Exploration fails after the base point has been reset as in the last paragraph, there is no use trying to continue with axial searches using the same step-size d. We therefore reduce the step-size d by an appropriate factor and prepare to restart the Exploratory phase again. However, if the reduced step-size d is smaller

Step	Description
HJ1	Enter n, *the number of parameters.*
	Enter d, *the initial step-size.* Enter R, *the reduction factor for* d.
	Enter tol, *a convergence tolerance on the step-size.*
HJ2	For i=1 to n. *Loop over the parameters.*
	Enter x_i, *the i'th parameter.*
	End of loop on i.
HJ3	Let b = x. *This requires a loop over the parameters.*
HJ4	Compute A=Z(b). Let B=A; let F=A. *The function value at the "old" base is stored in* B, *while the lowest function value found is* F.
HJ5	Perform AS,
HJ6	If F < B, then perform PM, let B=F, then goto step HJ5. *This sequence AS/PM (Exploration and Pattern Move) is continued as long as the function is reduced in each exploration AS.*
HJ7	If b ≠ x, then let b = x and goto step HJ5. *Note that this involves two loops over the parameters and resets the base point to that where the function value is lowest, as evaluated.*
HJ8	Let d=R*d, *to reduce the step-size. The reduction factor should be chosen to reduce the step-size reasonably rapidly when the initial point is close the the minimum.*
HJ9	If d > tol, then goto step HJ5. *Note: the tolerance should not be set to zero or a negative number.*
HJ10	Stop. F = Z(b) *is an approximation to the minimum value of the function.*

Figure 3. Algorithm HJ: The Hooke and Jeeves Function Minimizer

```
RUN

FNMAP - TWO PARAMTER FUNCTION MAP - 811031
B1:LOW,HI,# POINTS ? 0,9,46
B2:LOW,HI,# POINTS ? -5,3,25
MIN= 0
NEXT= .56888871
MAX= 1305
MEAN= 228.32256
KEY TO FUNCTION VALUES
SYMBOL          RANGE
 0             0 TO  28.54032
 1             28.54032 TO  57.08064
 2             57.08064 TO  85.62096
 3             85.62096 TO  114.16128
 4             114.16128 TO  142.7016
 5             142.7016 TO  171.24192
 6             171.24192 TO  199.78224
 7             199.78224 TO  497.49191
 8             497.49191 TO  766.66126
 9             766.66126 TO  1035.8306
 *               >  1035.8306

B(1) LIMITS:  0                                                    9
    B(2)
 2.9999999    444333333333334445566777777777777888888899999
 2.6666666    444333332222333334455667777777777788888889999
 2.3333333    544333322222222233344455677777777778888888999
 1.9999999    554433322222222222233344556777777777788888889
 1.6666666    655443322221111112222333445567777777777888888
 1.3333333    765543332221111111112223344556777777777778888
 .9999999     776554333221111111111122233445667777777777888
 .6666666     777655433222111110001111122233445667777777778
 .3333333     777765543322211110000001111223344567777777777
 0            77777665443222111000000001111223345567777777
 -.3333334    777777665443322111000000000111222344556777777
 -.6666667    7777777765443322111000000000011122334456777777
 -1           77777777765543322111000000000001112233455677777
 -1.3333334   877777777766544322211000000000000111223445667
 -1.6666667   8877777777776554332211100000000000011122334556
 -2           88877777777776654432211100000000000001112234455
 -2.3333334   888887777777777655433221110000000000000111223344
 -2.6666667   8888887777777777665443221110000000000000011222333
 -3           98888888777777777765543322111000000000000011122
 -3.3333333   99988888887777777777654433221110000000000001112
 -3.6666667   99999888888777777777765544322211100000000000111
 -4           *99999888888877777777776554332211110000000000111
 -4.3333333   **999999888888777777777776544332211110000000011
 -4.6666667   ****99999988888887777777777665443322211111000011
 -5           *****999999888888877777777776654433222111111111
```

Figure 4. Function map of the elliptical valley

than the convergence tolerance tol, the procedure stops, with **b** = **x** being the lowest point found (and our approximation to the minimum point of Z) and F is taken as the value of the function at the minimum.

The description of this procedure in words is surely more complicated than the programs which result. A step and description algorithm is given in figure 3.

To illustrate the operation of the Hooke and Jeeves method, let us try to minimize the function

$$Z(b_1, b_2) = 16(b_1 + b_2 - 4)^2 + (b_1 - b_2 - 8)^2$$

Obviously, the function is never less than zero because it is a sum of two squared terms. It can, however, be equal to zero when each of these terms is zero, that is,

$$b_1 + b_2 = 4$$
$$b_1 - b_2 = 8$$

so that by addition of these two equations, we obtain

$$2\,b_1 = 12 \quad \text{or} \quad b_1 = 6$$

Subtraction of the two equations gives

$$2\,b_2 = -4 \quad \text{or} \quad b_2 = -2$$

Thus the minimum is at $\mathbf{b} = (6, -2)$. Around this minimum, the function values increase regularly. If we make a rough plot of the function values, as in figure 4, it is seen that the shape of the function is an elliptical valley. As a starting point, let us choose $\mathbf{b}_0 = (0, 0) = \mathbf{x}$.

Listing 1 shows the output from a Basic program that implements the Hooke and Jeeves method to solve this minimization problem. The particular machine used was a North Star Horizon. The program itself is given as listing 2. To make clear what happens in the minimization process, the progress of the method up to the first step-size reduction is shown in figure 5.

The elliptical valley function is reasonably well-behaved in that the two parameters have similar scale. That is, a unit change in b_1 has roughly the same absolute effect on the function value as a unit change in b_2. For instance, the points labelled 19, 20, 21, and 22 in figure 5 all have the same function value of 17 (as per listing 1). Furthermore, it is easy to see from figure 4 that the function (at least apparently) varies smoothly over the ranges of the two parameters that we have been considering. As mentioned above, the Hooke and Jeeves method works best when the parameters are so similarly scaled. To illustrate the effect of poor scaling, some very simple changes are made to the elliptical valley function shown in figure 6. Notice how slowly the minimum is reached for case C, with over 8,000 evaluations of the function. This is really brute force to solve a relatively trivial problem.

In order to partially overcome the effects of differences in scale, one can try to introduce a modified form of the step in the axial search AS by using

AS2' Let g = b$_i$; let b$_i$ = g + d*(ABS(g) + d)

and

AS5' Let b$_i$ = g – d*(ABS(g) + d)

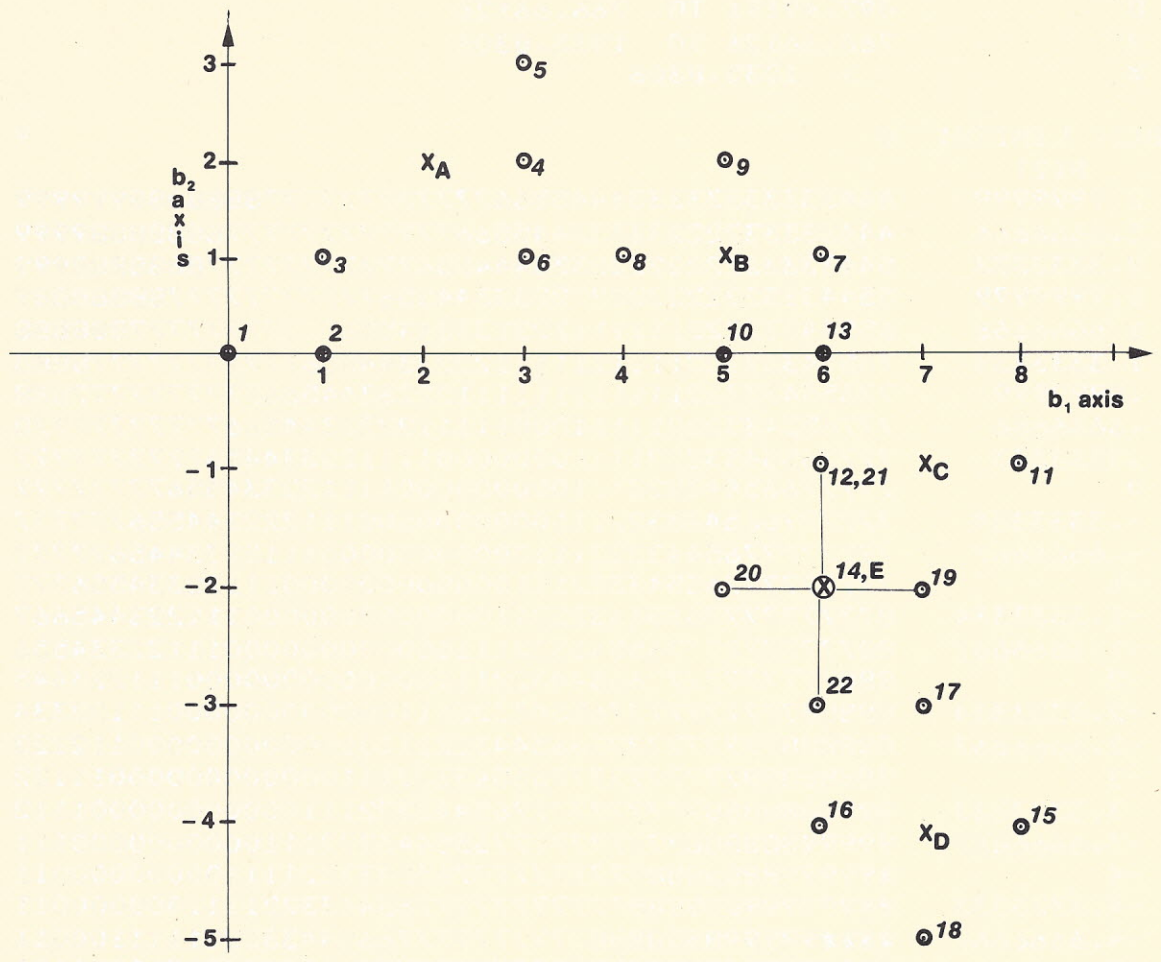

Figure 5. Progress of the Hooke and Jeeves method in finding the minimum of the elliptical valley problem. The function is evaluated sequentially at the points numbered in italic. The method is given point 1 as a starting place. Points 2 and 3 are generated in the first Exploration AS. Point A is made the new base in a Pattern move PM from point 1. The next Exploration AS tests points 4, 5 and 6. This cycle of Exploration AS/ Pattern move PM is repeated for the base points B, C and D. The Exploration AS about base D, however, yields no lower function value at points 15, 16, 17 and 18, so the method uses the lowest point so far (14) as a new base point (E). This happens to be the minimum, so points 19, 20, 21 and 22 all have higher function values. The step-size is then reduced and the method converges to the point E with Exploratory points lying on the lines joining E with points 19, 20, 21 and 22.

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Functional forms used:

(A) $Z(b_1, b_2) = 16\,(b_1 + b_2 - 4)^2 + (b_1 - b_2 - 8)^2$

(B) $Z(b_1, b_2) = 16\,(10\,b_1 + b_2 - 4)^2 + (10\,b_1 - b_2 - 8)^2$

(C) $Z(b_1, b_2) = 16\,(100\,b_1 + b_2 - 4)^2 + (100\,b_1 - b_2 - 8)^2$

In all trials: Initial step-size d = 1
Step-size reduction factor R = 0.1
Convergence tolerance tol = 1E-6
Initial parameters $b_1 = 0$, $b_2 = 0.$

Function	Stepping rule	Number of function evaluations	Final function value	Approximate minimum b_1	Approximate minimum b_2
A	AS2, AS5	42	0.0	6.0	-2.0
B	AS2, AS5	84	0.0	0.6	-2.0
C	AS2, AS5	8618	1.50592E-5	0.05998	-1.99824
A	AS2', AS5'	157	1.25346E-8	5.9999436	-1.9999445
B	AS2', AS5'	178	9.3824E-10	0.60000071	-2.0000129
C	AS2', AS5'	173	3.8113E-10	0.0599999	-1.9999917

Figure 6. Table of elliptical valley function changes. The effects of parameter scaling in the objective function on the performance of the Hooke and Jeeves method are illustrated with the elliptical valley problem.

The actual step-size used is now scaled by the magnitude of the parameter itself, but can never be smaller than $d*d = d^2$ even when the parameter is zero. This is important. Initial values of zero are frequently chosen, as we did above, in ignorance of better guesses. Also, a number of functions may be such that zero is a parameter value at the minimum.

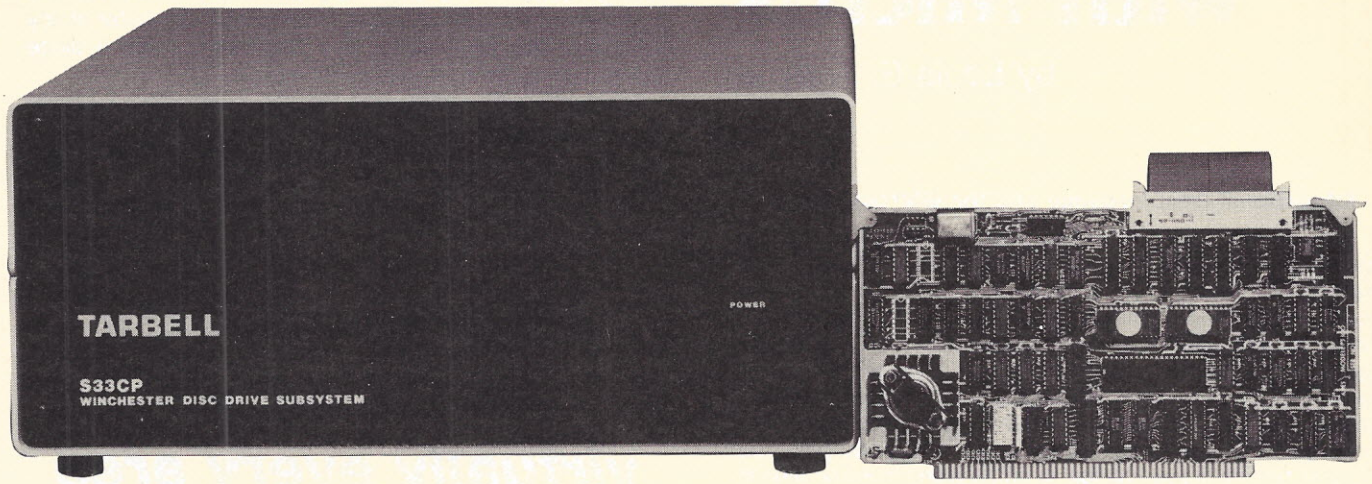
Figure 6 shows how this automatic scaling helps in cases where the function is badly scaled. However, it slows down the approach to the minimum when the function is well-scaled. For my own use, I prefer to use the automatic scaling and let the machine work a few seconds or minutes more on the problems of a "one-time only" nature. When the problem requires repeated solution, it is worth the effort to present the machine with a correctly scaled function.

The Hooke and Jeeves method is a simple heuristic function minimizer. It is very easily implemented and even if somewhat slow, has proven to be a reliable work-horse, particularly if attention is paid to scaling in the function and proper choice of starting values for the parameters. □

Program on page 146

S-100 Computer Owners...

Looking for more capacity, speed and reliability?



Tarbell 33 megabyte winchester subsystem

CAPACITY

Are you finding you need more disk memory for business applications? Tarbell's hard disk subsystems allow expansion from 10 to over 200 megabytes. And our ATTACH program provides a way to get up-and-running quickly. Start with a small system, if you like, then add up to four drives of any capacity.

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In most business applications, speed of the disk subsystem is the limiting factor for overall system speed. Major factors which affect disk speed are access time and data transfer rate. All Tarbell hard disk subsystems 33 megabytes and above use a voice-coil actuator which provides an average access time of 50 milliseconds. Data comes off the disk into your deblocking buffer at the maximum possible speed of 1 megabyte per second, meaning that a 24 kilobyte file can be loaded into memory in about one second!

RELIABILITY

Winchester drives have higher inherent reliability because the media and heads are in an air-sealed environment. Other types of drives are open to contamination from smoke, chemicals, and other particles in the air.

ADDITIONAL FEATURES

- Uses only one S-100 board slot
- On-board CRC performed on data
- Automatic alternate sector assignment
- 512-byte on-board deblock buffer

Subsystem includes S-100 interface, drive, cabinet, power supply, cables, software, and all documentation.

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Learning with Micros

by Louis E. Frenzel

Educational Obsolescence and the Microcomputer

Everyone has heard about how rapid technological changes erode the usefulness of our college educations. New developments in engineering and science occur almost daily. These technological developments usually have immediate impact on us, as they affect the way we live and work. And in many cases, these changes make the things we learned in college either irrelevant or totally obsolete. The thousands of dollars and several years expended on our college education sometimes seem wasted in view of the more telling changes. The biggest technological change to come along in some time is the microcomputer. Few technical developments have had a more profound effect on us.

Technological changes most affect those people working in science and engineering. Engineers, technicians, scientists and others who work in electronics, computers or related fields bear the biggest brunt of new developments. Scientists will never run out of things to research, thanks to change. No sooner does an engineer complete a design with a particular type of IC, than a new, better and cheaper IC comes out to invalidate his design. As soon as a field service technician learns to competently service a piece of equipment, it is quickly replaced with a better, more sophisticated unit obsoleting his capability.

But despite the disadvantages of change, most technical people find scientific and engineering advancements very exciting. This is partially what draws people to scientific and technical jobs. There is always some new component or technique to investigate.

It is a real challenge to stay abreast of such technical developments. In some fields such as electronics, the changes are so overwhelming that it is almost impossible for anyone to keep up with them. Paraphrasing what the Red Queen said to Alice in her visit through the looking glass, it takes all the running you can do just to stay in the same place —if you want to go farther, you have to run twice as fast. The only hope of ever becoming totally competent is to specialize in some particular field.

Considering the field of electronics, major technological changes have always caused major upheavals. The change from tube to transistors in the 1950s and 60s caused a major disruption in the industry. And it had profound effects on technical education. It took years for colleges to stop teaching vacuum tubes and start teaching the latest in solid state devices and circuitry. In the 1960s, integrated circuits caused another major disruption. Most people hadn't even become comfortable with transistors before integrated circuits came along and changed things again. Eventually developments in integrated circuit technology led to the development of the microcomputer.

The "computer-on-a-chip," or microcomputer, is now ten years old. In the past decade, it has established itself as a major electronic component. It has touched virtually every area of electronics during that time. It has completely changed the way electronic equipment is designed. It has also increased the practicality and usability of electronic equipment. The microcomputer has even made it possible to develop electronic devices that previously were impossible or impractical. Few developments in electronics generated such a broad and significant effect.

Yet amazingly, there are still many electronic engineers, technicians and others working in the field who have not been exposed to micros. Many engineers have not yet designed a microprocessor-based circuit. Many technicians have yet to service or troubleshoot a piece of equipment containing a microprocessor. And there are still many scientists and engineers who have yet to use or program a computer of any kind, much less a microcomputer. That fact is amazing, since the microcomputer has had such impact.

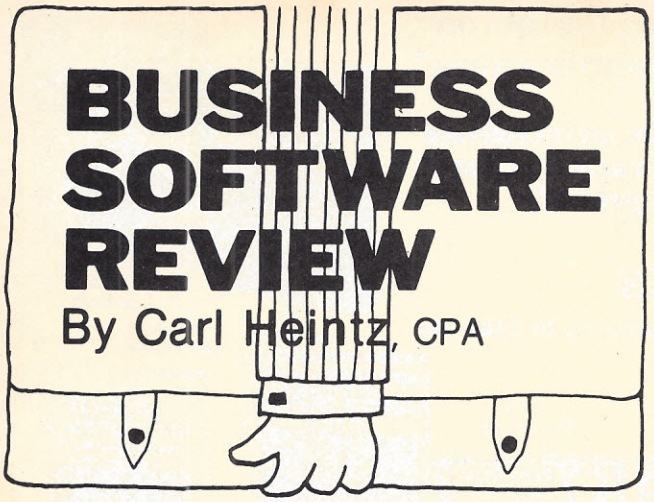
The technical people aren't the only ones who have been impacted by the microcomputer. With microcomputers so low in cost, easy-to-use and readily available, they are finding their way into virtually every business and institution. Small businesses are using microcomputers to speed up and simplify accounting and inventory procedures. Managers and executives in large businesses are using microcomputers for planning, forecasting and word processing. Microcomputers are even showing up in schools, and many teachers and students have taken a liking to them. There are even hundreds of thousands of computers in our homes, which are used both for entertainment and more serious applications like budgeting. Micros have caused not only a major technical upheaval, but also a social upheaval that has only just begun to penetrate all aspects of our lives.

Microcomputers have touched virtually every area of electronic design.

What is the solution to the educational or technical obsolescense? The answer is, of course, more education. There is no way to stop the rapid technical changes we experience. You wouldn't want to do this, even if you could, because it would take all the joy out of technology. Change is exciting despite the problems it causes us. But individuals can't just sit there and let technology overwhelm them. It can be overcome by fighting back. And the way to fight back is to learn more about it.

There are all sorts of courses being offered by colleges and universities as well as local continuing education organizations and private seminar companies. There are also thousands of books on the subject.

Finally, the best way to get on the microcomputer bandwagon is just to go out and buy one. They are really not all that expensive and they are a lot of fun besides. In addition to serious applications such as learning how to program and getting familiar with word processing, accounting, forecasting, CAI and other business related activities, there are always games to play. There is still no better way to learn than by actually doing. □



Demonstrating Who's Boss

The Boss accounting package, distributed by Lifeboat Assoc., New York, NY is a series of programs written in compiled Microsoft Basic. They include provisions for a general ledger, accounts payable and accounts receivable. The system does not include a payroll, inventory or order entry system.

The programs are designed for a CP/M or MP/M system, and require 54K of memory. Additionally, two diskettes with at least 240K each and a CRT display with 24 by 80 columns are necessary to use the system.

The manual is very comprehensive. It is oriented towards users with little or no computer knowledge. However, there are several sections that would be of interest to programmers only. In particular, the manual has a very extensive and well-presented discussion of the programs, what they do, and the files that are affected. Complete file structures are given. Since the source code is not supplied, users are unable to make changes to the programs themselves.

The approach taken by the system is a bit different from other accounting systems. Most have copied the manual method of accounting and function in some form of batch method. This system utilizes an on-line approach. The package posts transactions instantaneously to the detail. They are available for instant viewing. An extension of this on-line mode is the ability of the user to enter new customers, new accounts or new departments during the entry of transactions. Thus all information regarding a transaction may be entered at the same time.

The financial reporting capabilities are impressive. They include a full range of ledgers and journals. Journals and ledgers can be printed for each department or for an entire company. Income statements and balance sheets may be similarly produced by department, category or company total. To top it off, the income statement can be produced for the accounting period, fiscal year or for a selected range of dates. A comparative income statement for the last twelve months can be generated on a single page.

The balance sheet reporting system includes not only a current period balance sheet, but also a comparative 12-month balance sheet. Also, comparisons between the current, last periods and last year's corresponding accounting period are available.

The program includes provisions for generating the statement of changes in financial position—one of the most troublesome accounting statements for a computerized financial reporting system. The report is computed using the cash flow method (as opposed to the usual changes in working capital). Additionally, the system prepares a complete ratio analysis of the company's financial results. This system boasts reports that are just not available with other financial reporting systems. These reports are easy to obtain also, with no extensive programming necessary.

If all these reports sound too good to be true, they aren't. There is no catch to them—they work correctly, and are produced without any complicated user programming. Just how this complexity is reduced to simplicity is revealed to the user upon examination of the chart of accounts. The most vexing problem for designers or computerized financial systems is the design of the chart of accounts. The chart has a great deal to do with the structure of the entire system, and is linked very closely to the design of the financial reporting scheme in most computerized systems. The more flexible the system is about the use of the chart of accounts numbers, the more complex its financial reporting system will be. Some of the systems become quite cumbersome in their attempt to be flexible in the design of the chart and the ability to produce acceptably flexible financial reports.

The Boss system has taken an entirely different approach. The chart of accounts is set. The numbers are three digits, and they must conform to the following plan:

100-399 Assets
400-499 Liabilities
500-599 Equity
600-699 Operating income
700-749 Cost of Goods Sold
750-799 Direct expenses
800-899 Administrative Expenses
900-924 Non-operating income
925-949 Non-operating expense
950-999 Income Taxes

There is consolation to those who might feel that such a system is unacceptable. The system provides for up to 900 different accounts and up to 900 different categories (independent of department). With these parameters (which are specified separate and distinct from the account numbers), a number of different situations can be effectively handled. The simplistic chart of accounts structure may seem annoying or unworkable, but with a little creativity, the results are worth the effort. There really is no catch to using three-digit account numbers. It certainly does simplify matters.

The general ledger system allows up to 900 accounts and can accommodate up to 9,000 transactions in any one accounting cycle. Information is held in the system allowing for 12-month comparative analysis.

The accounts receivable and accounts payable systems that are integral to the system include provisions for up to 9,000 customers or vendors each, either open-item or balance forward (with either a printed or on-screen ledger), an aged report (four categories of aging), mailing labels and statements or checks.

Utility programs included

The system includes some interesting utility programs, including a loan amortization calculator that will produce a nice amortization table based upon the APR interest rate. Additionally, the system has a built-in depreciation calculation program that will produce a depreciation schedule based upon either straight line, sum of the years digits, or double declining balance methods. The utility programs do not update the general ledger—i.e. an additional journal entry is necessary. They do, however, calculate the information necessary for the journal entry.

The authors of the programs realized that the transaction-entry process is the most time-consuming and therefore one of the most critical elements in a successful implementation. For example, the user has the option of fixed point or floating point entries. Under the former, the operator would enter 123 and it would be interpreted by the computer as 1.23 (similar to the manner in which most accountants' calculators

work). In the floating point option, an entry of 123 is interpreted as 123.00. The journal entry form constantly updates the user on the footings of the journal entry, so that the user knows whether or not the journal entry balances. Further, the system will not allow the posting of a journal entry that is out of balance—no possibility of one-sided entries.

The same basic format is used for all accounting entry—general ledger, accounts receivable and accounts payable. As can be seen by its format, it is rather generalized. The Boss system is organized so that entry of all information is done in journal-entry fashion. In the case of receivables and payables, entries are made just as they would be if a manual set of books were kept, and detail ledgers were posted with each A/R and A/P accounting entry.

Journal entries are given a reference number by the computer. This provides for a good control over the journals, and a numerical audit trail. There are several different kinds of journals possible, including cash receipts, cash disbursements, accounts receivable, general ledger and accounts payable.

Maintenance is important

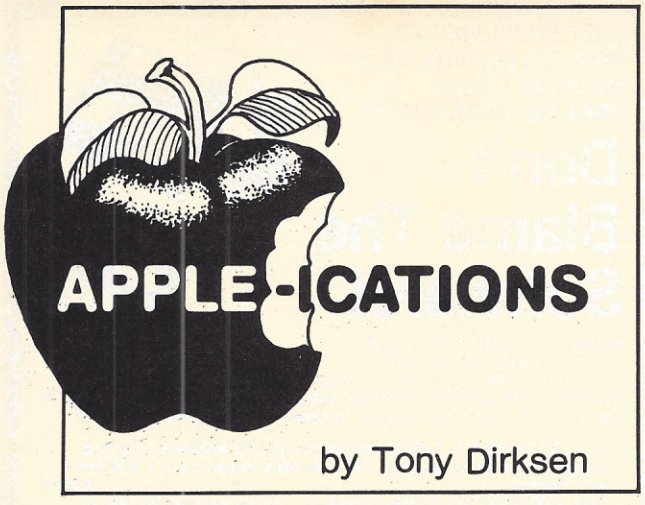
The receivables and payables system is, in some respects, similar to a sub-ledger system in a manual set of books. This is quite a bit different from some systems in which the programs are more oriented towards the management of the receivables or payables functions than in the maintenance of the general ledger. For example, although the system has a nice aging report, it does not provide for any collections activity, such as automatic collection notices. And although the payables system offers a nice aging, it does not provide for a cash requirements report. The receivables system is not linked to any sales entry system, nor does it interface with any inventory control program. Thus, the designers saw payables and receivables as an extension of the general ledger. Although technically correct, this is functionally unclear in many businesses. The receivables and payables programs do not include some of the "bells and whistles" that are contained by many other specialized applications programs specifically designed for receivables and payables. The amount of information stored for customers is significant.

Although the reports are extremely diverse, they are predesigned for the user, who has little (if any) say in their layout. That is fine for most applications, and certainly saves a considerable amount of time in the set up-phase. However, it involves some disadvantages. For example, it is not possible to lump all of the inventory accounts into one figure on the financial statements, unless the user uses a department or category to distinguish them (and uses the same account number for all of them).

It is not possible to print accounts out of chart-of-accounts order in the financial statements, either. Nor is it possible to format the financial statements in any form desired. The account names always print on the financial statements, so if an account is called Loan #123456 in the general ledger, that is the name that will appear in the financial statements. Further, since the chart of accounts is already set at three digits, there may be some industries in which the system just will not work. In the hospital industry, for example, regulations require account numbers to be set at 8 digits). On the other hand, automatic ratio analysis is unheard of in accounting programs, but the Boss produces an impressive 18 separate ratios and statistics.

The only really disappointing omission is a payroll module. Small companies need help in this area and its attendant recordkeeping functions. Since this system has so much going for it, it was unfortunate that this aspect was ignored.

Although Boss costs about $2,400 (expensive compared to most microcomputer programs), it really is composed of at least three modules—at $800 apiece. The programs represent good software that appears to be technically sound and well put-together. If one can overlook the few limitations, the system is an excellent choice. □



Micros Meet Mainframes

As personal computers have arrived on the desks of company executives and managers, these decision-makers have begun to develop a greater interest in the information available to them from the corporate mainframe.

At Chemical Industries Ltd., Toronto, Canada, for instance, where three dozen Apple computers have been purchased, the experience of working on small systems has given many employees a new perspective on their big computers. David Russell-Hill, manager of the firm's Operations Research Group, notes that "People are ready to understand the larger machines once they're sensitized to the power of personal computing."

Like most corporations, Chemical Industries needed solid reasons to justify its investment in the Apple systems; management decision support enabled by the computers made the purchase feasible. But developing increased computer awareness within the company has also been a major goal from the start. During the two years that the systems have been in use, more than 100 people have been trained on them. Executives and others without the time or temperament for on-the-job training have taken the computers home and learned some of the basics.

What's happened at Chemical Industries is likely to be repeated at many other firms over the next couple of years. The pattern goes something like this: First, the company buys personal computers as stand-alone systems for its personnel. Then the administrators start to experiment with ways to tie those microcomputers into their mainframes. (At Chemical Industries, for instance, the project began with the use of the Apple systems to link a Burroughs 7700 with the English parent company's IBM mainframe in order to transmit quarterly financial reports.) In time, they discover ways to integrate all the company's computing power into one organized system.

During the past two decades, computer technology has advanced much faster than most people's understanding of computers. The data processing revolution has done as much as any invention of this century to change how people live and work, yet most people still don't have a realistic idea of what a computer can do. But personal computers have made it possible for more people to understand the potentials of computers than ever before. Today, for the first time, the average person can take part in the computer revolution without becoming a computer expert.

This new flood of knowledge offers great potentials—as well as problems—to business and industry. An executive, for instance, will be able to get extensive information from the corporate data base, without waiting for the MIS department to crank out data. He can get the information in the form he wants when he wants it, intuitively piecing it together as he works, rather than having to define all the parameters before he starts. And he can use that information in any form he wants, from graphs to reports.

An executive who wants these capabilities could use one of the programs that allows an Apple computer to emulate a DEC VT-100 terminal: Access III (Apple III version) or the VT-100 Emulator (Apple II version). Both are available as Apple Special Delivery Software packages. (Apple's systems can also be set up with virtually any type of mainframe to work as dumb terminals.)

Access III gives the user a large buffer in which to work with data, so that files can be downloaded from the mainframe onto the Apple III, then worked with off-line. Apple has begun using the system internally in its MIS Department in place of DEC terminals. Even when the mainframe is down, Apple's system analysts can continue to work, using the data that they've already obtained.

Most of today's business applications for personal computers don't require any access to the company mainframe. Developing models for department budgets, generating graphs, processing words—all of these functions have traditionally been done with pencil, paper, calculator and typewriter, and don't require the resources of the corporate data base.

Putting a personal computer on every executive's desk, however, makes possible a host of new data processing applications that could require access to the mainframe, such as decision-making in fast-moving money markets. There can sometimes, however, be complications with increasing access to the corporate computer. How, for instance, can you ensure that the executive to whom you give access neither tampers with nor accidentally destroys any data? Traditionally, companies have used passwords to protect their data, but as more people gain access to their systems, the chances increase that someone will successfully break the protection scheme. A second problem is that the amount of time taken by an increasing number of users can put pressure on the mainframe work schedule. And novice mainframe users often lack the knowledge necessary to make sense of the abundant information in the corporate data base.

One way to protect against these problems is to download the data from the mainframe onto a separate mass storage device and allow employees to work from it, independent of the mainframe. Something similar to that is currently being done (for different reasons) by Arthur Young & Co., New York, NY.

Arthur Young, one of the "Big Eight" accounting firms, has been a leader in adapting to computerized auditing, and among the first to recognize how personal computers could help its auditing procedures. For the past few years, the company has been using microcomputers—principally Apple II Plus systems—in place of time-sharing arrangements for applications such as calculating cash flows, performing random samplings, and helping clients with their financial planning. Last year the AuditComputer, a microcomputer-based auditing system, was introduced. It's built around three pieces of equipment: a remote data capture unit, a 20M-byte hard disk for mass data storage, and an Apple III computer.

Here's how it works: Arthur Young's computer-trained auditors transfer selected financial data from the client's computer system onto the AuditComputer's hard disk. Data is transferred in one of three ways: a) directly from the client's computer facility via telephone lines; b) on floppy diskettes recorded in a standard format at the client's facility; c) by taking the remote data capture unit to the client site and connecting it to the client's computer.

Once the information is loaded onto the hard disk, Arthur Young's auditors use their own Apple III audit software to sample, analyze and review it. The system gives them the ability to examine and test client records produced on a wide variety of mainframe and mini computer systems, without disrupting the mainframe work schedule. Once the copy of the data has been created, no further time is required from the client computer.

The system offers other advantages as well. If a client has multiple facilities with different types of computers at each, the AuditComputer can download information from each and provide a central standardized format for testing. It enhances data security, since it only copies data from the mainframe, and doesn't modify the original information.

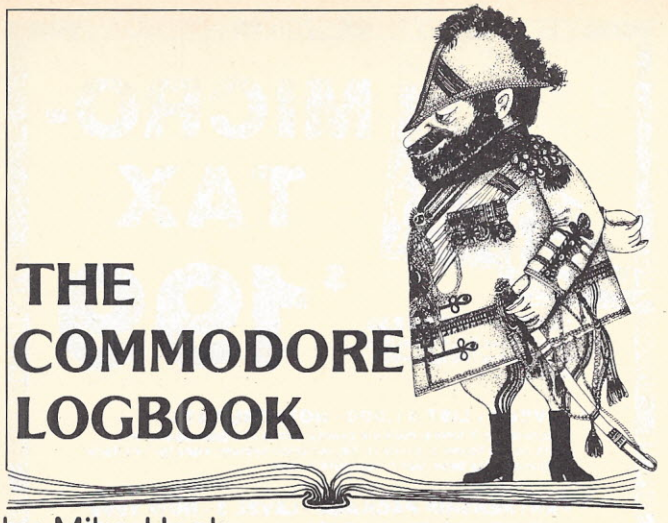
There are, of course, situations in which the AuditComputer cannot be used, especially if the audit requires them to review millions of transactions. In that case, as before, the Arthur Young auditors will run their audit software directly on the client's system.

This procedure of downloading information from the mainframe computer onto a separate hard disk may provide an answer to companies looking for a way to safely give more employees greater access to corporate data. Since the user will not have direct access to the mainframe itself, sensitive data can be protected. Yet executives and managers can have the most current information possible to help them run the company effectively.

In time, it should be possible to take information from the hard disk and plug it directly into applications programs, similar to the way Arthur Young auditors are able to take data from a variety of corporate mainframes and run their own audit software on it with the AuditComputer. So far, however, those program interfaces don't seem to exist, although it would seem inevitable that they'll be created as our applications needs become more sophisticated.

Several different mass storage devices work with Apple's computers, including Apple's own Profile 5¼-in. hard disk. With a storage capacity of five million bytes (or the equivalent of 35 floppy disks), Profile can store enough information for even highly sophisticated corporate analyses.

Micros are only beginning to meet mainframes in the types of applications discussed here. But more corporations than ever have made the commitment to personal computers, and many of their executive users will eventually want direct access to the central data base. The micro-mainframe combination is a worthwhile tool towards improved decision-making. □



THE COMMODORE LOGBOOK

by Mike Heck

Job Costing

In the last few months, a number of new or enhanced business applications have been released for Commodore Business Computers. The job costing system produced by BPI Systems, Austin, TX, enables the professional person or small business to take advantage of computerized accounting procedures. The programs include general accounting, accounts receivable, job costing, inventory and payroll. It is designed to operate on the standard CBM 8032 business system, with a CBM 8050 dual disk drive and dot-matrix printer.

Job costing, whether using a manual system or a computerized one, involves taking each separate component that goes into a job and estimating how much of each item will be needed to complete the job in terms of time, quantity or cost of subcontracting. In estimating a rebuilding project, for example, you might have to calculate foundation work, framing, roofing, and the cost of subcontracting items like electrical and plumbing work. Each of these categories would then be broken down further to account for labor and materials. You

CORNER CONSTRUCTION COMPANY

AS-OF 01/31/81 — JOB COST GENERAL LEDGER — PAGE 1

ACCT NO	ACCOUNT NAME	FOLIO	CURRENT MONTH	
1020	CASH ON DEPOSIT			
	SUMMARY FROM CASH RECD.	CR	11,052.00	
				11,052.00
1140	RETAINAGE ON CONTRACTS			
	SUMMARY FROM CASH RECD.	CR	1,228.00	
				1,228.00
1150	INVENTORY			
	SUMMARY FROM JOB COSTS	JC	1,110.00CR	
				1,110.00CR
1160	CONSTRUCTION IN PROGRESS			
	SUMMARY FROM JOB COSTS	JC	8,665.00	
	SUMMARY FROM LABOR COSTS	LC	2,567.00	
	JE # 2	GJ	10.00	
	JE # 2	GJ	10.00CR	
				11,232.00
1180	LABOR CONTROL ACCOUNT			
	SUMMARY FROM LABOR COSTS	LC	2,567.00CR	
				2,567.00CR
2005	DEPOSITS ON CONSTRUCTION			
	SUMMARY FROM CASH RECD.	CR	12,280.00CR	
				12,280.00CR
2010	ACCOUNTS PAYABLE			
	SUMMARY FROM JOB COSTS	JC	7,555.00CR	
				7,555.00CR
4011	CONSTRUCTION INCOME			
			.00	
				.00
5011	COST OF CONSTRUCTION			
			.00	
				.00
	TOTALS			.00

Figure 1. Job cost general ledger

CORNER CONSTRUCTION COMPANY
JOB STATUS REPORT PAGE 2
01/31/81

JOB: 1 REMODEL JACKSON BUILDING

% DONE	UNITS DONE/ EST	UM	ESTIMATED COSTS DONE/ ESTIMATED	ACTUAL COSTS TO DATE/ PROJECTED	% EST	VARIANCE (EST-ACT) ACTUAL/ PROJECTED	UNIT COST COMPUTED/ ESTIMATED
RF010	ROOFING SHINGLES						
100%	36	SQ	1,620	1,600	99	20	44.444
	36		1,620	1,600		20	45.000
RF050	ROOFING DECKING						
100%	4,000	FT	1,020	1,110	109	90-	.278
	4,000		1,020	1,110		90-	.255
RF100	ROOFING FELT PAPER						
100%	20	RL	210	195	93	15	9.750
	20		210	195		15	10.500
	RF WORKCODE		4,170	2,905	70	1,265	
	TOTAL:		4,170	2,905		1,265	
SC001	ELECTRICAL SUBCONTRACT						
0%	0		0	0	0	0	.000
	0		2,350	2,350		0	.000
SC010	HEATING & AIR COND. SUBCONT.						
25%	0		1,505	1,375	91	130	.000
	0		6,020	5,500		520	.000
SC020	PLUMBING SUBCONTRACT						
60%	0		953	895	94	58	.000
	0		1,589	1,492		97	.000
SC030	PAINTING SUBCONTRACT						
0%	0		0	0	0	0	.000
	0		3,016	3,016		0	.000
	SC WORKCODE		2,458	2,270	92	188	
	TOTAL:		12,975	12,358		617	
	JOB: 1 TOTALS:		12,818	11,232	88	1,586	
			23,335	21,320		2,015	

BPI SYSTEMS, INC.

Figure 2. Job status report

must be careful to account for all items and to accurately judge the quantity and cost of individual components.

Using a manual system, it is easy to miss items or make mistakes. The computerized system is designed to reduce greatly the amount of data to be entered manually. As such, when you enter a single transaction, the system automatically records it as a double entry to designated control accounts. Thus your whole operation is less prone to errors, and you'll gain a reputation for accurate estimates.

The system may be automatically merged, or interfaced, with the BPI general accounting and payroll systems. It may also be merged with any other bookkeeping system with a single journal entry. However, the job cost system is self-contained and may be used independently as a stand-alone package.

The system permits 300 work codes, under which costs are entered for an unlimited number of jobs (cost centers). Some of the enterprises the system is designed to serve include: general contractors, subcontractors, oil drilling operations, cattle feedlot operations, multiple rental properties, printing companies, and other businesses that require the maintenance of individual job cost records.

Features include: a computer procedure to help prepare an original bid (estimate) for a particular job; a journal to distribute all non-labor costs to various jobs; a journal for entering all labor costs and distributing labor costs to various jobs; an interim consolidated income and expense statement for all jobs; and an interim income and expense statement for each job. In addition a job status report for each job compares

actual costs to estimated costs on a percentage-of-completion basis. This report lets you monitor profit performance while a job is in progress. Updating of accounts payable in the general accounting system is automatically taken care of if you interface it with the job cost system.

Supplied with the program is a demonstration data disk and comprehensive user manual that takes you through the system in a tutorial manner by using the supplied data. Then you are instructed how to set-up the system to accommodate your own company. The user manual also contains worksheets that show how to organize information from a manual system into the proper form for the computer. All functions are selected from a main menu and many functions can be placed together in a queue for easy operation.

Before you begin creation of your data disk, you must choose a method of reporting income from jobs. The system uses two generally recognized methods of doing this: by completed job or by percentage of completion. Since this choice could be important to company profits, income taxes and financial statements, you should consult an outside professional to determine the best method for you.

Using the completed-job method, you don't report any income until the job is completed. You put any money received for a job into a current liability account - Deposit on Jobs. Costs for the job are put into a current asset account - Jobs in Progress. These accounts are kept on the balance sheet until the job is finished.

With the percentage-of-completion method, you record income for a job, as you receive it, directly into an Income account. And costs of the job, as you incur them, are recorded directly into a Cost of Sales account. These accounts are included in any profit and loss statement you prepare.

Once the method of reporting income is decided, Skeleton General Ledger accounts are entered. Up to 40 accounts can be used, but at least the following eight should be used: cash on deposit, retainage on contracts, jobs in progress, labor control accounts, accounts payable, deposit on jobs, income, and cost of jobs. Each account is also given a four-digit number. If you are interfacing the job cost system with the general accounting system, these control account numbers would be carried over.

Job Cost Register prompts are entered next. The purpose of these is to identify all skeleton general ledger accounts that are regularly credited when entering non-labor job costs. Up to nine accounts may be entered for prompts. For example, when invoices are entered, accounts such as accounts payable or inventory could appear each time as prompts. Using these prompts saves time by eliminating the step of looking up codes each time data is entered.

A vendor file is now created. Vendor numbers are used when you enter job costs, and these numbers are shown in the monthly job cost summary and in the vendor summary. You should also set-up a dummy vendor called Internal Inventory. This vendor can then be used to transfer materials from your inventory to a job.

The final step in creating a data disk involves entering work codes. A work code is any unit of work for which you decide to estimate expenses and accumulate costs. If the job involved printing a manual, the work codes might be: making separations, stripping, printing, bindery, and packaging. And each work code could be broken down even further.

Costs are totaled according to work code groups: the first two letters or numbers of the work code. These two-character work code groups let you organize cost information in a meaningful way.

The level of detail can be as extensive as you like. A maximum of 300 work codes can be active at any given time. Normally, the level of detail needed is obvious in the way a job is estimated. However, the system can be edited if you need to change the level of detail later. In fact, any information about your company that was entered in the set-up procedure can be edited or changed as the need arises.

Other important features include the built-in disk utility functions. These let you backup disks, delete a company or application, or move specific information to another disk. You can also check the amount of space left on a disk and move data to other disks as the active data disk begins to get full.

Once all your unique company data is entered into the system, day-to-day operation can begin. Naturally, estimating job costs is the first step before getting a contract or beginning work on a job.

Command 11 from the main menu lets you add a job estimate, change an estimate, delete an estimate or scroll through jobs.

The first step in adding an estimate is supplying the job name and job code. To actually estimate a job, you select and assign to it the work codes that will be the job components. The system will display all the work codes from the master list. You can select the code that is displayed or move on to the next work code. You can also specify each work code by ignoring the code displayed and entering the one you want.

For example, to estimate a printing job based on codes in the system, the computer would display the first one SP001, referring to separations, which might have been entered during system initialization. Next you can enter quantity or rate. These could have been specified during set-up, also. Total cost estimate usually equals quantity times rate. If you enter any two of the three, the computer calculates the third. Sometimes, rate and quantity are not applicable, and you can enter a total cost alone.

As you enter more codes, the system keeps a running total of the job estimate. At each stage, you are asked if the entries are correct. If not, you can re-enter data for the work code listed. Once you end the estimate, you can make further changes or add work codes easily. The total estimate can also be printed as a record for you or the client.

The cash receipts journal is a chronological record of cash received for the job. Cash received is automatically posted to

the skeleton general ledger cash account, retainage account, and to the job for which the cash was received.

Like the work codes, cash receipts can be entered in a batch mode at a convenient time. The system also provides a running batch total of the cash receipts as a check. If the totals don't match, you can review all entries before recording the data on disk.

Non-labor costs from vendor invoices and cost of materials transferred from inventory are entered with the ENTER JOB COSTS command.

For our printing company, if binding the printed job was handled by a subcontractor, you would enter the vendor number, invoice number, job code and work code (to allocate the cost to the particular work code for the job). Also displayed will be the job cost register prompts as defined in the set-up procedure. Here, we defined either accounts payable or inventory. You would enter the amount of the invoice to the accounts payable code. Conversely, paper taken out of inventory would be charged against the inventory account.

If you are using the job cost system in a stand-alone configuration, you would manually summarize gross wages by job codes and work codes. This information would then be entered into the labor cost journal.

Interfaced with the payroll system, much of this time-consuming hand calculation would be automatically handled for you.

The general journal is the most versatile journal in the system. Through it, you can make corrections or adjust entries in any account, job code or work code. If a work code was incorrectly charged with an invoice, the code could be credited with the amount in question and the correct work code debited with the same amount. As a check, the general journal balance must be zero.

The PERCENTAGE COMPLETE command lets you enter the percentage of work completed for each work code of one or more jobs. The system prompts with each work code for a particular job, and you enter the total percentage complete at this time.

This job cost system produces its own skeleton general ledger based on the particular general ledger accounts you select. Executing the POST SKELETON GENERAL LEDGER command performs four functions, depending on the current month's activities. First, for each journal, entries are sorted by account number and then posted to appropriate skeleton general ledger accounts. Then, the job cost general ledger (trial balance) report is printed. Next, this command prints a vendor summary report. Finally, this command also prints the monthly job cost summary report. This report summarizes all income received and charges to each job this month (or accounting period).

The job cost program also produces various listings, including: estimates, cash receipts, job costs, labor costs, general journal, retainage/profit and loss, job status, and profit and loss.

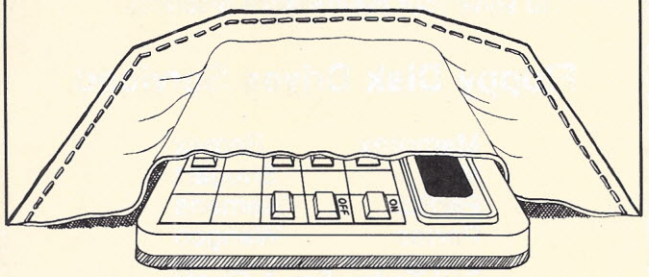
In the normal operation of the system, closing out jobs is the only procedure not already covered that you will need to be familiar with. Selecting the CLOSE JOBS command transfers income and expense information from an open job to closed job on the retainage/profit and loss and the profit and loss reports. If you selected the completed-job method when setting up the system, closing a job transfers the information from the balance sheet to the profit and loss statement.

An End-of-Month command is used at the end of each accounting period to close out the books. This command resets current month balances to zero. The system reminds you to back up the data disk, print all reports and post to the skeleton general ledger before executing the command, since details of the month's transactions will no longer be available on the active data disk.

A once a year END-of-Fiscal-Year command resets income and expense accounts to zero for closed jobs on the retainage/profit-and-loss, and job profit-and-loss reports. □

POWER IN YOUR POCKET

by Bob McElwain



Program Design: Another Approach

Basic on pocket computers is not as powerful as that of other computers. To some, this will appear to be a limitation. By using a different design, software can be produced that uses the simplicity of pocket computers to tremendous advantage.

This software will provide a generalized program that handles a task. Extensive documentation will be included that makes it easy to understand the program and shows precisely what program changes are needed in order to perform the task with specific parameters. Many examples will also be included so that programs can be tested after user modification. Suggestions for a variety of applications will be given. Notes must be sufficient to allow the user to personalize the program to fit his needs by following simple directions. The program design will remain unchanged. The parameters will be defined by the user.

This design, providing for user modification of code, is possible only because the pocket computer is so easy to use. Users of larger computers modify code at great risk. The frequent result of even a simple change is a system crash. Most software vendors void all warrantys on any code change. Many seek to lock up code, so that user modification is not even possible. To offset this lock, they design the software so as to provide as many options as possible. Users select freely and safely from these options when the program is run. Hence, most computer users need to know little or nothing about the program they are using.

Most users of pocket computers will become at least novice programmers, simply because it's easy to do so. Editing will be an easy task. If directions are clear, users will be able to modify programs correctly to provide those options that cannot be built into the program because of system constraints (e.g. memory size). In fact, a greater variety of options will be available when code modification is provided for.

I believe program designs that support user-modification of code will be extremely successful in the future. They may bring a vast new dimension to computing. Although many people will remain content with the options available on larger systems, pocket computer users will demand total control. Creative software producers will recognize this demand and meet it.

The accompanying program is an example of such a design. All the complex indexing is written in general terms, to be ignored by the user. Some suggestions for user modification have been included, but many others are possible. It is a program design that could multiply into a hundred different versions in the hands of as many people.

Years ago, General Electric had a very popular program on its timeshare system called FAL (Financial Analysis Language). Now, programs such as VisiCalc have been implemented on micros. These programs are also very popular. In simple form, these programs allow the user to enter an array of data and extend or project this data vertically and horizontally according to user-selected algorithms.

This program offers a pocket computer version of these programs. Since memory is limited and assembly language is not available, it is necessary to edit the actual code to obtain the desired options.

The program as listed accepts up to eight elements in each of three rows. The elements in the second and third row are subtracted from the elements in the first row, while the sums are held in a fourth row. The elements in each row are then totaled and averaged. Next, the average rate of change is determined for each row. An unlimited number of projections can be made based on the average rate of change.

Consider the following:

	1	2	3	TOT	AVE	%	4
1	16	24	32	72	24	41.7%	45.3
2	4	8	12	24	8	75.0%	21.0
3	9	12	15	36	12	29.2%	19.4
4	3	4	5	12	4	-62.5%	4.95

If data is entered as above, rows 1-3, column 1-3, first the sums, row 4, are computed (16 – 4 – 9 = 3). Then the rows are totaled (16 + 24 + 32 = 72) and averaged (72/3 = 24). Next the average percentage of increase is computed: ((24 – 16)/16 + (32 – 24)/2 = .4167 = 41.7% Projections are made in subsequent periods by applying the average percent of change to the amount in the last column. For example, the first projection in the first row would be 32 + .417*32 = 45.3. Note that 4.9, in the lower right hand corner, is the sum of the projections, not a projection of previous sums: (45.3 – 21.0 – 19.4 = 4.9).

The accompanying table shows the results of a run in which the first row might represent gross sales, the second row—cost of sales, the third row—cost of goods, and the fourth row—net sales.

Projected Sales of Widgits (in 1000s)

	1978	1979	1980	1981	TOT	AVE	% CHANGE ACTUAL	1982	1983	% CHANGE LESS INFLAT	1982	1983
Sales	34.5	38.4	41.7	48.6	163.2	40.8	12.15	54.5	61.12	5.15	51.1	53.73
C/Sales	5.9	4.8	4.2	3.8	18.7	4.68	-13.56	3.28	2.84	-20.56	3.02	2.4
C/Goods	18.6	20.4	22.7	25.1	86.8	21.7	10.51	27.74	30.66	3.51	25.98	26.89
Net	10.0	13.2	14.8	19.7	57.7	14.43	15.2	23.48	27.62	8.2	22.1	24.44

Elements underlined were entered. The balance of the table was computed.

The combination of rows to a sum is performed in a subroutine beginning in line 900. If the signs of operation are changed to plus, this model would handle three sets of stock prices, comparing them to the total. Any linear combinations of these rows are possible by changing line 905. For example: The sum of rows 1 and 2 can be divided by one-half row 3. Use: 905: A(H + (B – 1)*A) = (A(H) + A(H + A))/A(H + 2*A)/2. It should not be necessary to change the indexing of A.

The total and average of each row are computed in Lines 300-340. This section can be changed as needed. Code to perform other tasks can be substituted. It can also be deleted for space (approximately 175 bytes).

The inflation factor (lines 600-630) allows the use of an estimated percent for inflation. This amount is subtracted from the calculated rate and the result is used in calculating row projections (See last three columns in the table). If this factor will always be used, it could be subtracted in line 535 when the average rate of change is computed. If it will never be needed, this segment can be deleted (approximately 150 bytes including line 60) or other code could be substituted.

As listed, the program allows three rows with up to eight elements in each row. An additional two elements in each row must be held for the rate of change and work space for projections. A fourth row is required for the sums of each column. These values are set in line 10 and A = 10, the number of columns and B = 4, the number of rows. As listed, the product of A and B cannot exceed 41 or else variable space will collide with program space; if deletions are made, the number of columns can be increased in line 10 with no further changes. So 32 bytes must be deleted to add one column.

The number of rows can be decreased by decreasing B in Line 10. Also delete the appropriate terms in line 905. The number of columns can be increased accordingly.

Increasing the number of rows, without deleting, requires decreasing the number of columns. Change A and B in line 10. Another term must be added in line 905 for each additional row.

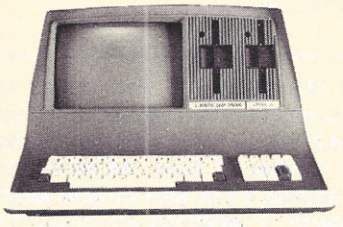
Casio users should omit all reference to G. This is the offset required on Sharp/Radio Shack units to avoid program variables when using A(N). With the listing in this form, variable must be expanded to have room for 44 variables. □

Program listing on page 148

BRAINS - MAINFRAMES

SUPERBRAINS

ZENITH



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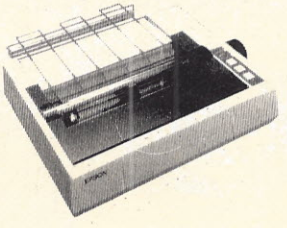

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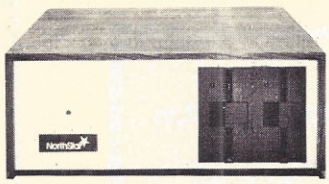

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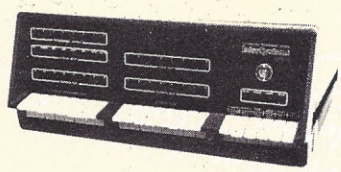

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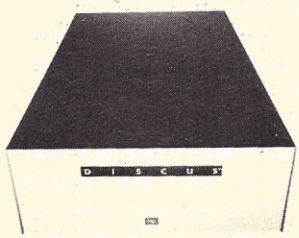

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CIRCLE INQUIRY NO. 84

Assignment: Benchmark

Twelve-System Summary:
North Star Leads Field

	C-3 Accounts Receivable Time	Current Price
Pertec PC 2000	6:04.3	$12,470
North Star Horizon	1:57.7	$ 6,911
Cromemco System Two	2:48.0	$ 9,275
Texas Instruments Model 771	3:38.1	$12,100
Vector Graphic System B	5:56.5	$ 8,995
DECstation 78	5:04.8*	$10,495
Radio Shack TRS-80 model II	3:38.6	$ 7,609
Apple II +	6:17.4	$ 4,330
Digital Microsystems DSC-2	3:28.8	$ 9,015
Ohio Scientific C3-A	15:49.3	$10,940
Alpha Micro AM-1011	3:25.3	$15,605
Data General CS/10	**	$13,400

*Result includes both compile and run time.
**Time of 2:40.3 was obtained using hard disk system.

by Hillel Segal

With a performance that was especially notable in view of its relatively low price, the North Star Horizon finished ahead of the pack in benchmark testing for systems priced under $15,000.

Twelve systems were compared in the Association of Computer Users' Series 1 Benchmark Reports, using a variety of different tests. Reported here are results from one of the real-life problems, the accounts receivable program. In that test, the Horizon excelled—spurred by its fast floppy disk and floating point hardware option.

Several of the other computers gave results nearly as good, and only one computer looked outdistanced. The Ohio Scientific C3-A's time in the accounts receivable test was slower than expected, and this seems a bit hard to explain when you look at its results in other tests, which were about average. The benchmark testers explained that the Ohio Scientific's accounts receivable time was caused by a single buffer for I/O. They indicated it was a problem that could be programmed around, so that a single result should not be taken as a totally accurate measure of the system's performance.

Of course, speed is not the only factor in choosing a computer, and these tests should not be used as one's sole criterion in choosing between systems. Factors such as software, language, storage capacity, expandability and vendor support must be weighed just as carefully as system throughput.

Other features, including business-oriented applications software, vendor training, service and documentation are outside the scope of objective testing. A system with seemingly lackluster speed may have significant capabilities in software that provide extra functionality or ease of use. It may have special peripherals, software compatibility, or other important characteristics.

Review of the contenders

Pertec PCC 2000—The capabilities to expand the system from single to multi-terminal use and add hard disk storage were notable features. The operating system is CP/M-compatible, allowing a wide selection of languages and programs. Pertec offers its own software for business accounting, and the system is normally sold through local dealers who provide a complete hardware/software system. Benchmark performance was fair.

North Star Horizon—Startling higher-priced systems with its I/O speed, the Horizon did well in nearly all the benchmark tests. It uses CP/M and has floating point hardware (optional) for faster math execution. A hard disk is also available. However, the system seems to require a more technically-oriented user to take advantage of its flexibility and features.

Cromemco System Two—Posting good to excellent benchmark times, the System Two has since been given faster floppy disk drives and an optional multi-user Cromix operating system. Lisp and RPG II have been added to Basic, Pascal, APL, Fortran, Cobol and Assembler—a wide selection of languages. The hard disk System Z-2H was also tested and showed improved I/O times. Word processing and data base management software are available.

Texas Instruments 771—A solid performer in benchmark testing, the 771 is most often sold through OEMs who supply a complete hardware-software package. Texas Instruments provides Basic, TPL (terminal programming language) and utilities, but no user programs. With excellent communications facilities, the 771 is often used as a pre-processor for data entry jobs.

Vector Graphic System B—Once the firm's sole product, the System B has now been joined by the VIP, 2800, and hard disk 3005. The System B uses a CP/M, MDOS or MZOS operating system, allowing a variety of languages. Powerful word processing software is available as well. Benchmark performance was about par.

DECstation 78—Although not a benchmark standout, users felt the DEC 78's ease of use and applications software were strong points of the system. Basic is compiled, and has 16-digit accuracy. Offered along with word processing and accounting software, the system can be purchased from DEC computer stores and OEMs, as well as the manufacturer. Price quote was obtained from the computer store, where it is cheapest.

Radio Shack TRS-80 model II—Using 8-in. floppy disks, this is the biggest TRS-80 model offered, and it can be purchased with accounting and finance software for small to medium-sized companies. Benchmark times were very good for the price. Usable with TRSDOS or CP/M (from outside sources), it runs Cobol, Fortran and Compiled Basic, in addition to regular Basic and Assembler.

Apple II +—Winner of the "lowest priced system" award for this series, the Apple was not as fast as some systems, but did not finish last on any test. Excellent color graphics is a big feature, while the 40-column upper case-only screen characters are a drawback. (Optional 80-character expansion is available.) Pascal, Fortran and both integer (model II) or floating-point Basic (II +) are offered. Testing was done with floating-point system.

Digital Microsystems DSC-2—Significant storage expansion using hard disks and a head-per-track option were outstanding features. Using either the CP/M or Oasis operating system, the DSC-2 handles Basic, Fortran, Pascal or Cobol. Since testing, though, Digital Microsystems has replaced the DSC-2 with two new systems, the DSC-3 and DSC-4. The DSC-3/101 with 10-million character hard disk costs $8,995 (less printer), placing it very close to the price of the floppy disk-only DSC-2.

Ohio Scientific CS-A—Overall excellence in the benchmark testings for this system was belied by a poor time in the accounts receivable test, apparently caused by use of a single buffer for I/O. The single test is therefore not totally accurate as a measure of performance. The C3-A and hard disk-equipped C3-B can be expanded to multi-user multi-task configurations.

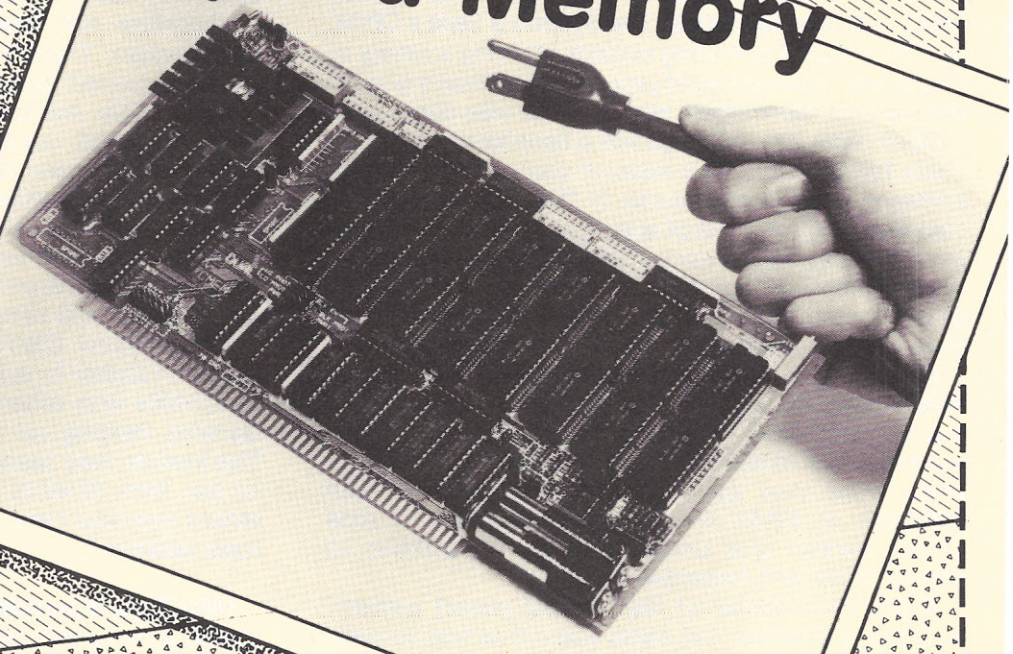
Alpha Micro AM-1011—Nudging just over the price limit at $15,005, the Alpha Micro provided some of the fastest benchmark times tested in this series. In addition, the AlphaBasic language has strong features, and the computer sported floating point hardware, a real-time clock and excellent utilities. Pascal and Lisp are also furnished with the system. Multi-user options are available, and hard disk expansion is offered.

Data General CS/10 Model C1—The only system tested in Cobol in this series, the CS/10 is software compatible with other commercial systems from Data General, ranging up in size to large minicomputers. The system was tested using the optional hard disk, so the time (2:40.3) is not directly comparable to others reported here. Price is $17,400 with this hardware addition. □

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several other foreign countries. A complete package of information about the organization is available from ACU, Box 9003, Boulder, CO 80301.

Hardware Evaluation:

Dual Systems' 32K CMOS Non-Volatile, High-Speed Memory



by Roger H. Edelson

There is a handy solution for those who are tired of waiting while their operating system loads in, or worried about power failure during the finishing touches of a 1,000 line program. A non-volatile memory could be just the solution—if it doesn't introduce more significant problems of its own. Core memories are difficult to interface and require substantial operating power, while CMOS integrated circuits have, heretofore, been too slow, and required too much space. Dual Systems Corp., Berkeley, CA, has solved these ancilliary problems with its recently announced line of high-speed CMOS memories, which are available in 8K byte increments up to a full 32K on a single board, ranging in price from $895 for the CMEM-32K, to $695 for the 8K board.

CMOS memories can be used as non-volatile storage, though they actually are as volatile as almost any semiconductor RAM, because they require so little standby power that it is feasible to provide backup power from on-board batteries. For example, the fully populated 32K board (the CMEM-32K) requires a maximum of only 20 microamperes current consumption during standby, making it possible to retain data for a guaranteed three years with the on-board lithium batteries. An additional advantage to be gained by using CMOS integrated circuits is very low operating current consumption—only 650 milliamperes typical (1 Amp. maximum) for the 32K board.

To effectively transform normally volatile semiconductor memory into non-volatile storage requires more than just supplying backup power; additional design techniques and circuitry are required to provide the necessary data protection schemes. The data protection systems must protect against both power failure and inadvertent data ensure, or over-writing. The data protection system in the line of CMEM memories includes an on-board circuit that generates an interrupt

when a drop is detected in the computer system power. This interrupt enables suitably programmed systems to store critical data before the power fails completely.

To protect against accidental data/program loss, the CMEM series has a programmable Write Protect Window (WPW), which can be used to enable a selected region of memory for writing, while keeping all other memory locations write-protected. This feature allows part of a program, or selected data, to be changed without the risk of accidently over-writing other data or memory locations that must not be altered. With this safety

Compliance with I.E.E.E. 696 ensures compatibility between the CMEM line and most S-100 bus systems

feature, the CMEM boards exhibit the same data retention quality as EPROM memory, while providing the speed and instant write-ability of any high-speed RAM.

In order to insure compatibility between the CMEM line of memories and most S-100 bus computer systems, the boards have been designed to be fully compliant with I.E.E.E. 696, the proposed standard for the S-100 bus. With this design, data byte sizes of either 8 or 16 bits may be used, and the board will support the extended 24 bit addressing. For systems that do not support the extended addressing capability, the CMEM boards provide Bank Select, enabling compatibility with the earlier, pre-IEEE 696 standard computers (such as Cromemco and North Star Horizon). The bank select design is compatible with most current techniques, using an I/O port to enable or disable the board. The output port address is switch-selectable on any even address within the I/O address space.

The board is designed to function in an industrial environment, and the construction techniques ensure reliable operation in this usage, with each board subjected to 200 hours of burn-in to catch any infant mortality problems. The card edge connector is gold-plated to provide both low noise and corrosion free interconnection to the S-100 bus. Wave-soldering techniques have been used to enhance the reliability of the unit (all the feed-through holes have solder fillets) and contribute to the professional appearance. In the accompanying photo, note the inclusion (and even labeling) of two spare IC locations. The solder masking is excellent, and adequate silk-screened identification has been provided to locate any component; even the most important signal lines are identified. To ease servicing, all the integrated circuits (not just the memory chips) are placed on the board using sockets, a very wise move. The designers have considered one of the most trying problems confronting memory system designers—noise, and have provided more than sufficient numbers of filter capacitors to eliminate this problem. The board, as purchased, provides pins 20 and 70 as additional ground connections (as specified in IEEE-696) to reduce noise, but should your pre-standard computer

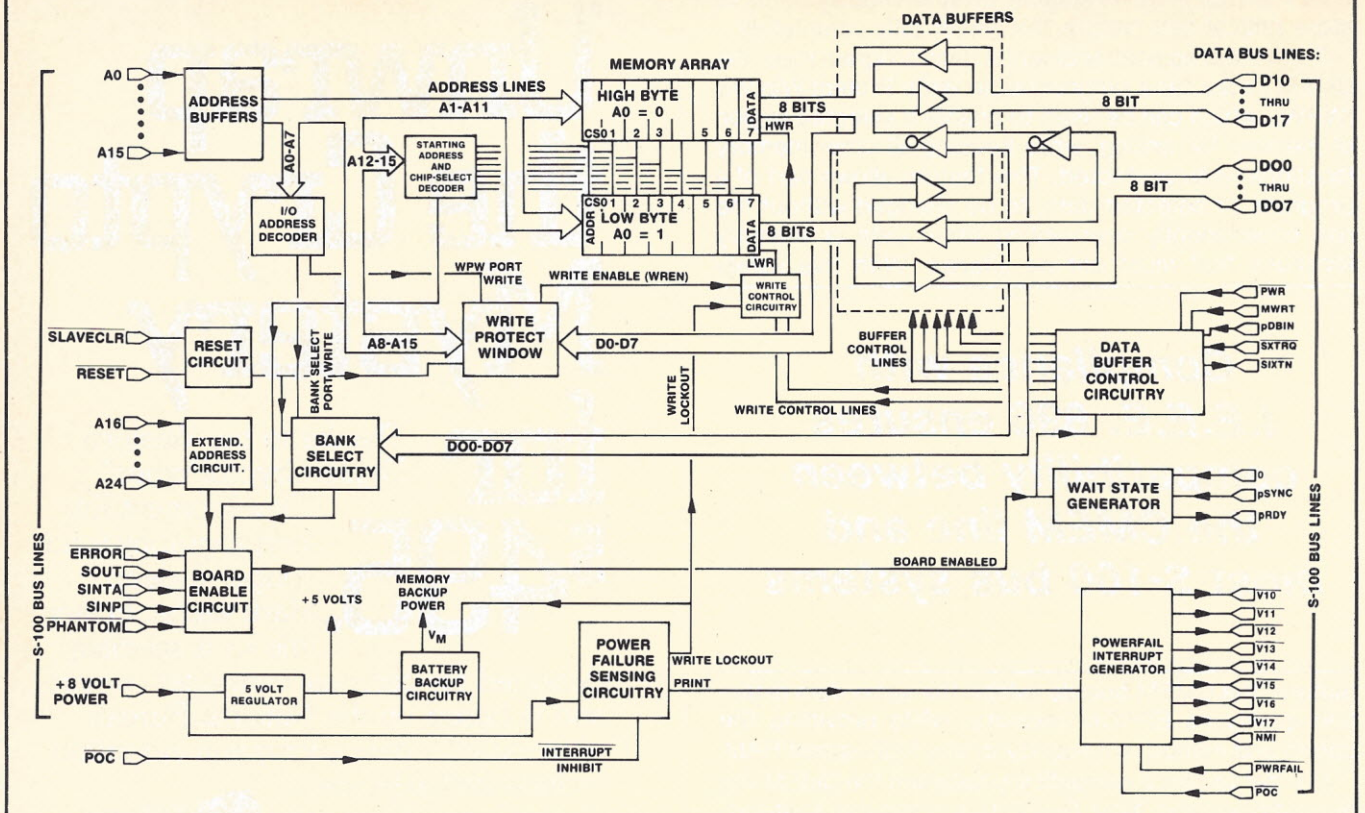


Figure 1. Block diagram of the CMEM series non-volatile memories

system use these pins for some other function, the company has provided on-board cuttable traces to allow the user to free up these functions.

Before reviewing in detail specific designs and functions of the CMEM line of memories, let's take a quick overview of the specifications and features. As mentioned previously, the boards are available in capacity increments of 8K bytes up to 32K per board. The memory chip is a high speed 2048 by 8-bit CMOS static RAM integrated circuit (the 150 nS Hitachi HM-6116, or equivalent). The memory chip is fast enough to allow a maximum access time of less than 200 nS, which provides the ability to operate in 4 MHz Z80 (or Z80A) computers with no wait states. Provision has been made to allow the inclusion of a single wait state when operating with faster (e.g. 8 MHz) systems. The memory is arranged as a single contiguous block, but the starting address may be set for any 4K byte boundary within the 64K byte address field, and any 4K byte block may be enabled, or disabled, by means of DIP switches. Memory address selection is performed by means of switches, which makes the board very user-friendly. In fact, all the more needed user selectable options are controlled by DIP switch settings—a very nice touch.

To maintain compatibility with the IEEE 696 bus standard, the CMEM line supports both extended addressing and the 8- or 16-bit word size. When the extended addressing is enabled, (again by means of a DIP switch), lines A16 through A23 are used to determine which 64K byte page the CMEM will occupy within the entire 16M-byte address space. The board meets the timing and logical requirements of the 8/16-bit word size specified in the IEEE standard. The generation of the SIXTN* signal requires that both the 16-bit mode and the board be enabled.

To retain full compatibility with earlier, pre-standard, boards, the CMEM series allows use of the Phantom signal (Pin 67) and MWRT/PWR select option. The Phantom signal option allows the board to de-select itself, regardless of the state of the address lines, when this switch is on and the PHANTOM line of the S-100 bus is activated. The MWRT/PWR option allows the CMEM of memories to operate with most standard S-100 bus systems (those using MWRT), but will also work with those somewhat non-standard systems that do not provide this signal. Actually, the only non-standard feature of these boards is the schematic, where "barred" signal names rather than the new standard NAME* are used to represent active low signals.

While IEEE 696 compatibility is very important, the major feature of these memory systems is the Write Protect Window coupled with the data retention/protection function. After all, the main reason for purchasing this board is to obtain a non-volatile memory capability. A block diagram showing the functional interrelationship of the major functions and circuits of the CMEM series is provided in figure 1. Note the interconnection of the Power Failure Sensing Circuitry with the Write Control and Powerfail Interrupt circuits. The Powerfail Interrupt Generator may be configured to use the S-100 bus PWRFAIL* signal (specified under the IEEE 696 Standard, and therefore not available on all systems) to generate a non-maskable interrupt (NMI), or one can use the on-board generated PFINT signal for this function. The CMEM manual recommends the

use of PFINT, as the S-100 bus PWRFAIL* signal is so rarely available. A nice touch is the use of wirewrap posts and easily reconfigurable jumpers to make this mode selection.

To derive the most benefit from non-volatile high-speed memory, the powerfail interrupt sequence must allow the computer system to quickly store its status and any critical data at the first indication of an impending power failure. If sufficient energy storage is provided by the power supply filter capacitors (which is usually the case) to allow 10 or more mS of computer operation after the detection of an imminent power outage, a suitably written interrupt routine can store all register contents in the CMEM address space. When power is later restored, the computer can begin program execution at the same place it left off, with all critical data also restored. It is the PFINT* signal derived by the CMEM onboard Powerfail Sense Threshold circuitry that initiates this sequence, and also restores normal operation. The powerfail sense threshold is preadjusted at the factory, and normally does not need to be re-adjusted. As set, the PFINT* signal is generated when the S-100 bus +8 volt unregulated power form falls below +7.4 volts. When this input falls another 0.4 volts, the write lockout circuit begins operation preventing writing or erasure of the memory contents. An adjustment has been thoughtfully provided by the designers of this board in case the factory settings result in system crashes in normal operation, or data is lost from the CMEM when power is turned off.

To make full use of the powerfail detection and interrupt circuitry, the CMEM boards provide a software programmable WRITE PROTECT WINDOW (WPW), for which patent protection is being sought, which gives these memories a degree of data protection approaching that of a disk, or magnetic tape, without sacrificing the speed of a semiconductor RAM. To allow the maximum flexibility of use, the WPW is provided with four different basic operation modes, plus the option of no write-protection at all. Appropriate use of the WPW can prevent the majority of instances of data loss caused by system crashes. To achieve this protection, the WPW is set for the HIGH PROTECT mode (protecting all addresses of the CMEM memory that are at, or above, the specified address) and the WPZ switch is set to ON. With these conditions set up, the board will come up fully write-protected. The power-up routine must then have an OUT command as its first instructions to change the write protect boundary. This will allow writing in desired areas of memory. Once writing to the CMEM memory area has been completed, the CPU should OUT another instruction, which will again set those portions of the memory that store the critical data to write-protect status. This memory partitioning is illustrated in figure 2. Of course, if the important programs are located in the lower region of memory, the LOW PROTECT mode should be used.

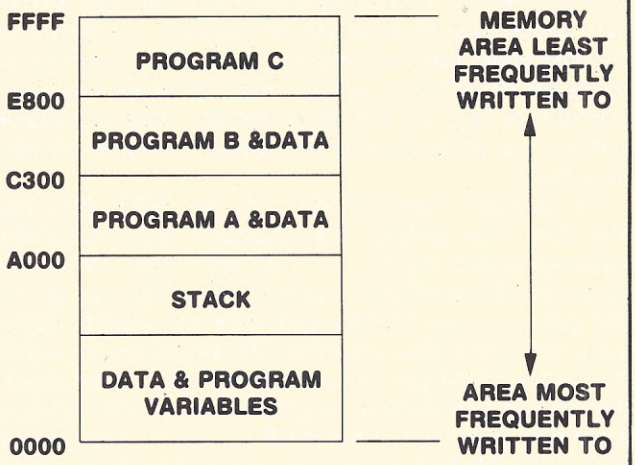


Figure 2. Memory map of address space showing high protect mode

The CMEM boards provide the user with a host of selectable options, including address location, bank select, wait state addition, and even error de-select using the S-100 bus ERR signal. However, the proof of the pudding is in the operation. In my system, the board was fully protected against system crashes under all operating conditions encountered, including power failure caused by a lightning strike on a nearby sub-station transformer. In this last case, when power was later restored, the computer returned to the same simulation I was running when the lights went out. I have even used the board to transfer a program from one computer to another by storing the data in the CMEM board, then transporting the board to the second S-100 bus system. For a 4MHz non-volatile memory to provide data security, the CMEM series provides a rugged board with 5-10 year storage, at a reasonable price. □

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What the 1981 Tax Law Means to You

by Vernon K. Jacobs

There are some major changes in the tax laws involving business equipment that will influence your 1981 tax bill. That assumes you purchased some additional equipment or bought your computer during 1981. A variety of other changes in the tax laws that were enacted as part of the Economic Recovery Tax Act of 1981 will take effect in 1982 or later. There are at least 109 specific provisions in the 1981 tax bill, but only a few specifically relate to computer owners.

When a computer is used for investment or business purposes, it can be depreciated over its useful life, which means that the cost is taken as a tax deduction over a five-to-seven year period. The new law replaces the concept of depreciation with a system of "cost recovery." The difference is that useful life is no longer relevant. In addition, the full cost of the first $5,000 of equipment can be fully deducted in the year it is purchased. Some favorable changes were made with respect to the rules for claiming an investment tax credit on the price of business or investment equipment. Some new rules were also created to encourage businesses to increase their research and development efforts—and these rules will affect many computer owners.

One of the provisions of the new tax law will permit businesses to deduct the first $5,000 of business equipment acquired in 1982 and 1983, the first $7,500 of purchases in 1984 and 1985 and the first $10,000 of purchases after 1985. This means that many small desktop computers or related equipment could be fully expensed in the year acquired. No investment credit would be allowed on such purchases. If the cost of the computer equipment exceeds the fully deductable amount, the excess would be eligible for the new cost recovery method described below.

The new tax law specifically states that this provision

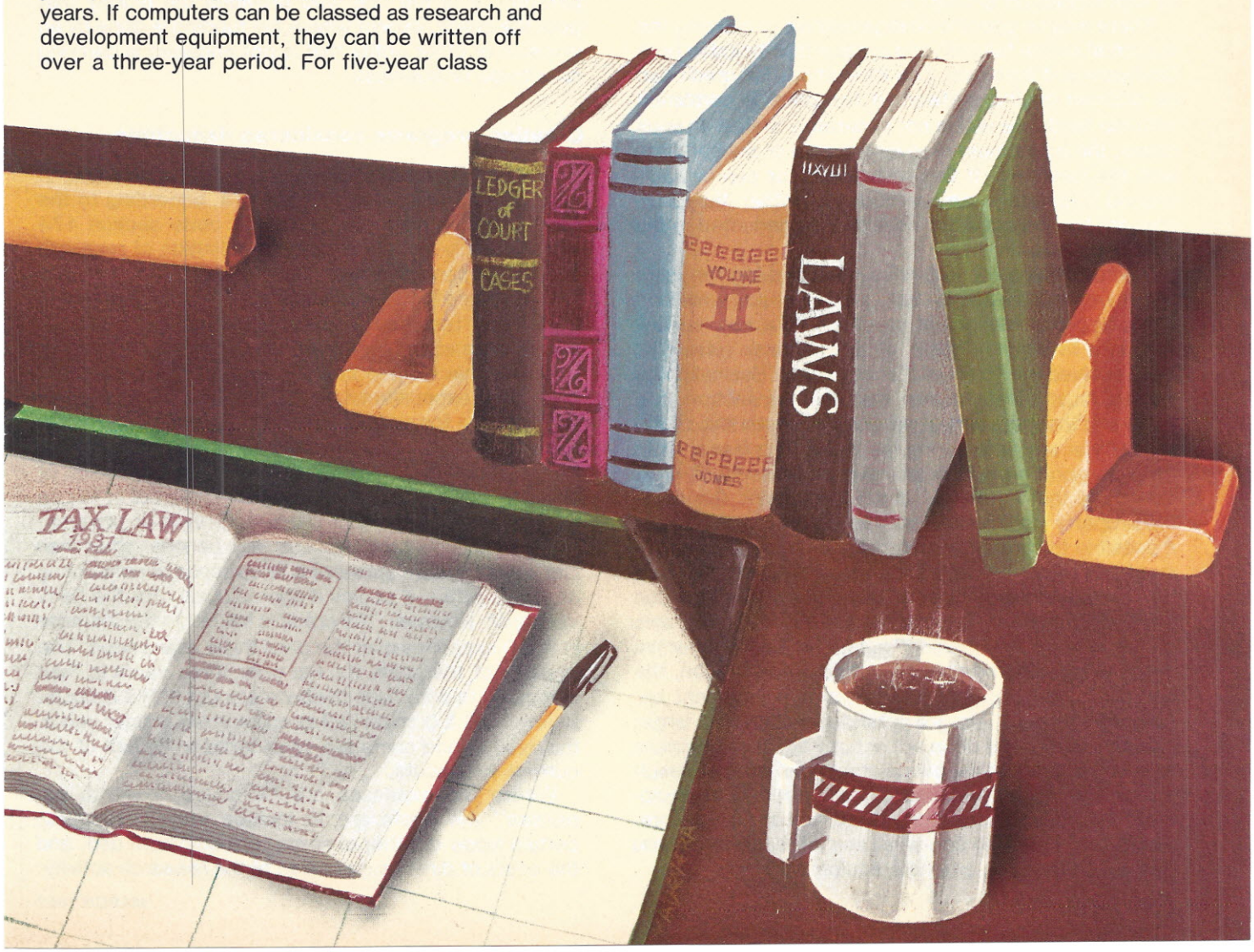
is an election that the taxpayer must make. The taxpayer can therefore choose whether to take the full write-off for the first $5,000 of equipment purchased in 1982 and give up the 10% tax credit, or whether to use the five-year cost recovery and to take the 10% tax credit. This full write-off election is not available for your 1981 tax return that is due by April 15, 1982 (or by June 15, 1982 if an extension request is filed). Any equipment that was purchased in 1981 must use the new cost recovery method.

Another restriction on the use of the full write-off provision is that it is only available for equipment to be used in a trade or business. The IRS and the courts have held that managing investments does not constitute a trade or business, but property rental may be considered as such. An activity does not have to be full time to be considered a trade or business, and the courts have held on some occasions that an employee is engaged in the trade of being an employee. Therefore, if the computer is used in connection with an employee's work or as an educational tool that is necessary to maintain employment skills, the taxpayer could take the position that the deduction should be allowed. However, the taxpayer should also expect the IRS to take a fairly restrictive position on these issues.

If you purchased a computer in 1981, the 100% write off won't be available, but the new method of depreciation (called the Asset Cost Recovery System) does apply to 1981 equipment purchases. Under the new method, computers will be written off over a five-year period, using specified rates for each of the five years. If computers can be classed as research and development equipment, they can be written off over a three-year period. For five-year class equipment purchased in 1981 through 1984, the first year's deduction will be 15% of the cost. The second year's deduction will be 22% of the cost and the rate will be 21% in each of the next three years. The entire cost will be deducted over the five-year period.

By contrast, the prior law permitted a computer owner to write off up to 40% of the cost in the first year, if the equipment was placed in service before July 1. An additional 24% of the cost would be written off in the second year, 14.4% in the third year and 10.8% in the fourth and fifth years. This assumes a five-year life, which has been typical for computer owners. Consequently, owners of larger and more expensive computers won't fare any better under the new law than they did under the old.

If the tax deductions can't be utilized because of other tax deductions or business losses, computer owners will be able to elect to write the equipment off over a 12-year or 25-year period, using a straight line method of cost recovery. However, the election to use the slower method is mandatory for all of each year's purchases—and you can't change your mind after a year or two. The main reason for using a slow method of cost recovery is to avoid the possible loss of deductions during a prolonged start-up period due to the existing time limit on offsetting losses of one year against profits of future years. The new law provides substantial relief in this area—which may make the slower write off method unnecessary. Previously, business losses could be carried forward for seven years, but the new law



"Taxpayers and the IRS have been arguing for years about whether a lease is just a method of financing a purchase."

extends this to 15 years (retroactive to 1976).

Computer buyers will realize a small increase in the amount of available investment tax credit for purchasing a computer. Under prior law, equipment with a five-year useful life was eligible for ⅔ of the full 10% tax credit. Equipment with a five-year life will now be qualified to claim the full 10% tax credit. If the equipment will have a three-year recovery life (autos, trucks and certain R & D equipment), the tax credit will be 6% of the cost of the property rather than 10%. These new tax credit rules take effect in 1981—including property that was acquired before the law was passed. (It was signed on 8/13/81.)

There was no specific change relative to claiming the tax credit on the full cost of a system that included both hardware and software. The investment tax credit can be claimed on the software if the price is combined with the hardware and is not separately stated. In such cases, the buyer must recover the cost of the software with the hardware. If the software is, or can be, purchased separately, and is licensed rather than purchased, the full software cost can be deducted in the year of acquisition.

Taxpayers and the IRS have been arguing for years about whether a lease is really a lease or just a method of financing an equipment purchase. The new tax law attempts to simplify some of the complex rules that have evolved in this area of controversy. Basically, the parties must clearly agree that the transaction is a lease and the lessee must not acquire ownership of the property at any time during the lease. The lessor must be a corporation and must have an investment of at least 10% that is "at risk" in the investment. Generally the property must be new property. This change makes it possible for profitable corporations to acquire equipment and lease it to less profitable companies, so that the tax advantages flow to the corporation that can best utilize them. The advantage to the less profitable company is a lease of equipment under favorable terms. While the leasing company must be a corporation, the company that is leasing the equipment need not be. Although these rules are intended mainly for larger companies, the law does not set any limits on minimum or maximum size transactions or companies. As a result of this change in the tax law, leasing computer equipment may become much more attractive than before. Therefore, check to see what sort of lease terms you can get before you buy new equipment.

The new tax law provides a special tax credit for part of a taxpayer's wages and supplies used in research and development activities. The credit can be as much as 25% of the incremental research and experimentation expenses made after June 30, 1981 and prior to January 1, 1986. Incremental expenses means the excess of research expenses in the current tax year over the average research expenses in the prior three years. However, the credit is not available for research conducted outside the U.S., for research in the social sciences or humanities, or research funded by any other person or government agency. In the case of the "other person," it is the one who provides the money that gets the credit, except where the funding is done by an investor or other entity that is not engaged in carrying on a trade or business.

Creating programs considered deductible

The definition of qualified research is to be found in Internal Revenue Code section 174, according to the 1981 tax law. The trouble is that code section 174 doesn't really include a specific definition of research and experimentation expenses. Instead, the definition is to be found in IRS regulation 1.174-2 which states in part that "research and experimental expenditures means expenditures incurred in the taxpayer's trade or business that include costs incidental to the development of an experimental or pilot model, a plant process, a product, a formula, an invention, or similar property, and the improvement of already existing property of the type mentioned." That appears to include the cost of creating a computer program either to market or to use in developing some other product, formula or process.

The R & D tax credit applies to expenses rather than just wages. Where software is an expense of conducting an R & D effort, it seems it should qualify for the 25% tax credit. However, the credit is limited to the *increase* in R & D expenses over the prior three year period. The average of the costs for the prior three years is then computed to determine the base amount of R & D costs. Where no R & D costs had been incurred in prior years, the base period costs are considered to be half of the current year costs.

Where the expenses are "in-house research expenses" the costs are to include wages, supplies, certain lease or other charges for equipment use, and the costs of direct supervision of the research activity.

Differences in direct and combinational purchases

	Tax Recovery	
Taxable Year	*Software Only*	*Combination Purchase*
First Year	$300	$145
Second Year		66
Third Year		63
Fourth Year		63
Fifth Year		63
TOTAL	$300	$400
Present Value @20%	$300	$296

When some or all of the research costs are paid to or incurred by any person other than an employee of the taxpayer, only 65% of the cost will qualify for the R & D tax credit.

The tax treatment of computer programs depends on how the programs are acquired. If the programs are included with the related equipment and the price is not separately stated, the programs may be treated as part of the equipment. This means the implicit cost of the programs will be eligible for the investment tax credit because the equipment will be eligible for the credit. It also means that the program cost must be deducted over the five-year equipment recovery period.

If the programs are developed by the taxpayer (or by his employees), the taxpayer can elect to expense the costs each year as they are incurred, or to capitalize them, then amortize the costs over a five-year period—or such shorter period as the owner can "clearly establish."

If the programs are acquired separately from the equipment, the tax treatment depends on whether the program is purchased or leased. As a general rule, if a program is created by an outside firm to meet the buyer's requirements, the program will be considered purchased. In a few cases, a packaged program that is made available by a company marketing programs may be sold without restriction. But most packaged programs are "leased"—even though a single fee is paid in advance. If a program is leased, the lease payments are deductible when paid, even if the entire payment is made when the program is acquired. If the program is purchased, the taxpayer must amortize the cost over five years, or a shorter period if the program won't last that long. It stands to reason that if a new program must be purchased each year because of frequent changes (i.e., a tax program), the amortization period should be one year.

For simplicity, let's assume you are considering the purchase of a computer program with a one-year useful life at the same time you are considering the purchase of the equipment. Given the choice, should you buy the program with the equipment or should you buy it separately? If you buy it with the equipment, you might claim a 10% investment tax credit, and you will still deduct the full cost over a five-year period. If you are in the 30% tax bracket, you will get back 30% of the cost of the program from the cost recovery deductions and another 10% from the tax credit. However, by deducting the program in one year, you will expedite the time when you will get the tax recovery from the program. You will also lose the investment credit.

How can you estimate what to do? In the first year, an immediate deduction for software will generate $300 of tax savings for each $1,000 of cost (assuming a 30% tax bracket). If the software is included with the hardware, the tax credit will generate $100 of immediate savings, which can be added to 30% of the first year's cost recovery deduction. Under the new law, 15% of the cost is deducted in the first year. That will produce $45 of tax recovery, so that the total recovery will be $145 when the investment tax credit is included.

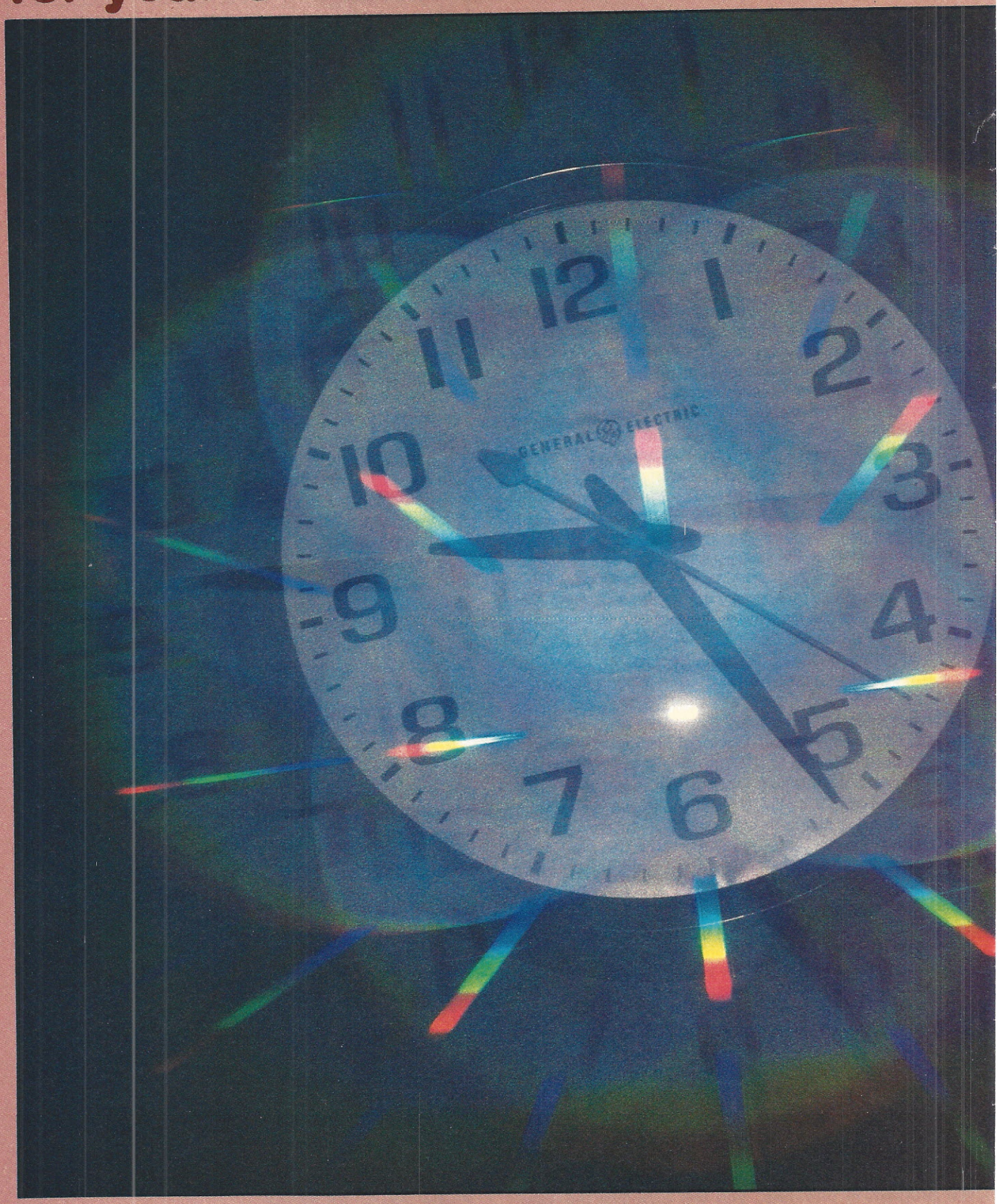
In the first year, the immediate write-off will provide $300 of cash tax savings, whereas the tax credit and first-year deduction will produce a first-year tax recovery of $145. However, by purchasing the software with the hardware, you would still be able to claim an additional $850 of cost recovery deductions during the next four years. The additional tax recovery would be $255—in addition to the first-year amount of $145. This makes the total tax value of the direct purchase $100 less than a combination purchase. The difference is the amount of the investment tax credit, of course. But there is a timing difference, as illustrated in the accompanying figure.

If the $300 could be invested to yield 20% compounded tax-free for four years, it would accumulate to about $400. This means that the direct purchase of software is the same as a combination purchase if the cost (or yield) of money is 20%, after taxes. If the cost of money (or yield) is less than 20%, the direct purchase is best. The combination purchase will be best when the cost (or yield) of money is more than 20%. (All of this is based on a 30% tax bracket.)

See related article on page 94. □

Vernon K. Jacobs is a CPA and CLU who practices as a tax consultant in the Kansas City, KS area. He is the editor of Tax Angles, *a monthly tax strategy newsletter for taxpayers and the author of* The New Taxpayers' Counterattack, *both published by Kephart Communications, Alexandria, VA. In addition to writing, lecturing and consulting on taxes, Jacobs has developed a tax forecasting and planning program for microcomputers that use the CP/M disk operating system. His program, Shortax, is marketed by Syntax Corp., Box 8137-P, Prairie Village, KS 66208.*

Timesharing vs. Buying— Which is Best for your Small Business?



by
David D. Busch and William M. Taylor

Small business owners and others needing computer power today often can pare their choices down to two options: do they want a little bit of a very big computer—or would they rather have one microcomputer all to themselves?

In the early days of computers, it was thought that timesharing would be the wave of the future. A few massive networks of mainframes would be sufficient to link up all users in the U.S. Each would have a terminal, and share time, a nanosecond at a crack, with the other users. Computers were so big, so complex, and so expensive that it seemed inconceivable that a small business owner would ever be able to dedicate one to the needs of a single operation. Of course, in those days they didn't have $200 hand held, battery operated computers with an 11K ROM, either.

Today, timesharing remains a viable alternative for many businesses. The option has some important advantages. But for those who don't need a huge variety of languages and compilers, or the possibility of nationwide local phone call access, an in-house micro may be the answer. To complicate things a little, there is a third choice. Computerization can be obtained with almost no user involvement through batch processing provided by an outside service bureau. In such a case, all keypunching and other functions are performed offsite. The business owner sees nothing more than the computer's output—paper reports, microfiche, checks, or invoices.

Interestingly enough, the deciding factors involve a great deal more than just the cost of the three alternatives. Each option provides its own set of capabilities and culpabilities, along with the requisite number of pros and cons.

Today's business owner can enjoy the benefits of a computer without the liabilities of a data processing department. Actual involvement with the nuts and bolts can vary, depending on the inclination and interests of the business person.

Using an outside service company for all of a business' data processing chores is undoubtedly the simplest

way to convert from manual accounting and reporting to computerization. There is no need to establish a data processing department, nor any direct cost for computer or maintenance. You don't even have to know exactly what you want your computer to be used for.

A representative of the service bureau will visit your operation, and conduct a survey to determine how computerization can best be applied to the business. They are experts in this area, have seen hundreds of businesses your size, and know what it takes to automate.

On-site computers can reduce processing expenditures during rapid growth periods.

For most standard functions—accounts payable/receivable, general ledger, payroll, or inventory—the service bureau will offer standard packages that may be run with few changes. You don't have to pay for program development—just minor alterations that make the software more or less suitable for your particular business. This means that you may have to alter your working methods, reports and other operations, in order to fit the packaged program.

However, the cost/benefit ratio may be attractive enough for the business person to offset minor (or even major) inconveniences. The lure of computer speed for time-consuming functions is a powerful one. The increased control over finances and additional information available through sophisticated reports can also outweigh the need to adapt to a packaged software system.

Reports may not always be in the form you'd like to see them, nor offered at the times when you could use them most. Small users may find themselves boxed in to receiving only monthly reports that would be useful on a weekly basis. Or the report may be offered on the 15th of the month, when it would be most valuable on the first. Usually, accommodations can be made to suit these special needs, but at an additional cost that may outweigh the benefits. Remember, a service bureau is able to offer computer services at relatively low cost only through mass production techniques, and standardized operating procedures. A small business will not want to pay for developing programs from scratch—typical fees run from $12 to $15 and up per line of debugged Cobol code. Special services require special fees.

A realistic initial charge for a service bureau would be $500 for the minor program development required, and $75 to $100 per month for the first one or two applications. After a firm has become a regular customer of the service bureau, add-on charges might drop to $50 per month additional for each standard application on the computer.

A professional person (an attorney, doctor, or dentist) who sees a great many people, and who has a large number of monthly billings to make could benefit from a service company. They could pick up the books, key-enter the requisite information, print out and mail bills, and present the business owner with aged reports, and general ledger information. A small retailer—an independent hardware store, for example—could achieve greater turnover of inventory and fewer lost sales through computerization. Even small manufacturing operations sometimes turn to an outside company when they are not ready for their own computer. Unless you have a very small business, or several employees with time on their hands who could perform tasks during wasted periods, it would be difficult to do them at less cost manually.

A service bureau represents a perpetual cost, however. It will never be fully paid for. You will have the monthly charge for as long as you remain with the outside data processing company. Worse, as your business grows, the charges will rise commensurately. An in-house computer grows in quantum leaps as the need for external memory grows. In between those jumps, a rise in sales volume, or new applications adds no new charges other than those for personnel to key in the information and operate the computer. Service companies may charge on a per-item basis that can rise almost in direct proportion to the growth of the business. I have talked to dozens of small business users who found that converting to an on-site computer enabled them to reduce their data processing expenditures as a percentage of sales during rapid growth periods.

On the plus side for the service company, however, is the fact that maintaining the computer, the software, and absorbing the cost of replacing and upgrading equipment can be amortized over a large number of individual users.

Timesharing requires no large investments

Timesharing has many of the same benefits of the service bureau, with some additional ones as well. The business person does not have to bother with the selection and maintenance of a complete computer system. Large mainframe power is available with no investment in a data processing staff or programmers. Standard software packages are available for use as-is, or after minor modification at reasonable cost by an outside software house.

However, timesharing requires slightly more involvement by the business person. A terminal (and possibly a printer) must be obtained, and decisions must be made as to which timesharing service to use. Many large scale computer users lease out part of their mainframes' time to small businesses, even though they are not, strictly speaking, in that line of work.

Colleges, government agencies or private companies such as Boeing Aerospace, have computer time that they do not need, and offer timesharing as a way of allowing the computer to help pay for itself. You may have to seek out these sources; they generally don't go around knocking on doors like the service bureaus.

There are also companies that specialize in timesharing and service bureau work. The largest may also sell online data bases or, like Compuserve, hobby and personal computing services. National time sharing services, such as Tymshare or Comshare, can be available to any user in the U.S. who has access to a Telenet or Tymnet node.

For most small business applications, data input and retrieval functions will frequently be performed by a person who is relatively untrained in computer science

—the realtime online processing equivalent of a key-punch operator. Invoices must be entered, time cards compiled, or payments posted. However, hiring and training these operators represent additional functions and expenses generally not encountered in the service bureau environment.

This relatively minor involvement will be a plus for some. The business person can get much deeper into computer work. A nearly unlimited selection of languages, compilers and utilities are available. A powerful computer may be called on at any time, practically as if the business had the expensive machine on its own premises.

However, the computer may not always be as available as you would like. Your local access node may be overbooked, in which case you can wait, or absorb the cost of a long distance telephone call to connect through the next nearest access point. Large scale computers also sometimes go "down," and the potential for data loss can be huge.

Fortunately, all timesharing systems have utility programs and procedures for recovering lost files. In addition, disk files are backed up onto tape at intervals. At worst, you might lose the five days' worth of data since the last backup. This information can generally be re-entered with only minor time lost.

Timesharing, like the service bureau, is a never-ending cost that tends to increase in volume. You are charged for CPU time, not connect time, at rates ranging from an average of $200 per hour to $800 per hour and higher. However, this usage is measured in increments of a nanosecond, although there is a trend towards using the picosecond as a time unit. Other functions, such as "gets," "puts," tape mounts and plotting are billed at their own rates.

There is one advantage of timesharing that cannot be beat, however. When using a national company, with many access nodes, it is possible for a relatively small company to gain a continent-spanning online computer system that can be accessed by all.

This type of networking should be a growing application in the future. Businesses that market all across the country frequently set up small sales offices throughout the nation. Larger firms have branch factories or assembly points. All can use timesharing to give each office access to a company-wide data base, or to provide data processing for the organization as a whole.

Combining the two options

Very large firms, such as the airlines, make good use of such timesharing, but use their own computer system. A large photographic manufacturer, on the other hand, chooses to lease time from a national timesharing service for its computerized photofinishing lab quality control system. The same company's equipment service division tracks parts inventory and keeps customer service history records online through an outside timesharing computer.

Finally, the logical progression after service bureau and timesharing is the on-site computer. As costs for micros drop dramatically, while their power approaches that of minis and maxis, many users are finding that they can skip the first two options entirely.

A micro is a possibility, even for those who do not wish to learn much about computers, and how they operate. With some help in choosing a suitable hardware and software configuration from a knowledgeable friend, collegue or computer store sales person, a workable turnkey system can be purchased for $5,000 or less. You should be certain that you are receiving good advice, especially as to the size of the system. The complete neophyte might very well expect that a cassette-based color computer system with a 21-column screen display can prepare the payroll for a 200-employee company. The dangers of misinformation and overexpectation are among the chief drawbacks of small computer ownership or leasing. It always helps to gain some basic knowledge of microcomputers, through reading books and magazines, even if programming skills are not at the top of a business person's list.

No special expertise is needed

Knowing a high level language, let alone assembler or machine language, is not a prerequisite, at all. The omnipresent standard software packages are available for purchase by micro users as well. However, it can be very useful to have some familiarity with Basic, Cobol or whichever language your software is written in, so that you can make minor modifications yourself. An alternative would be to find a software house in your area that can do this work for you at reasonable fees..

No special expertise is needed to operate these packages. BUILD files, chain commands, menus, interactive processing, and other features incorporated into the software by the programmer can make operation as simple as answering questions and hitting the correct keys to invoke the function desired.

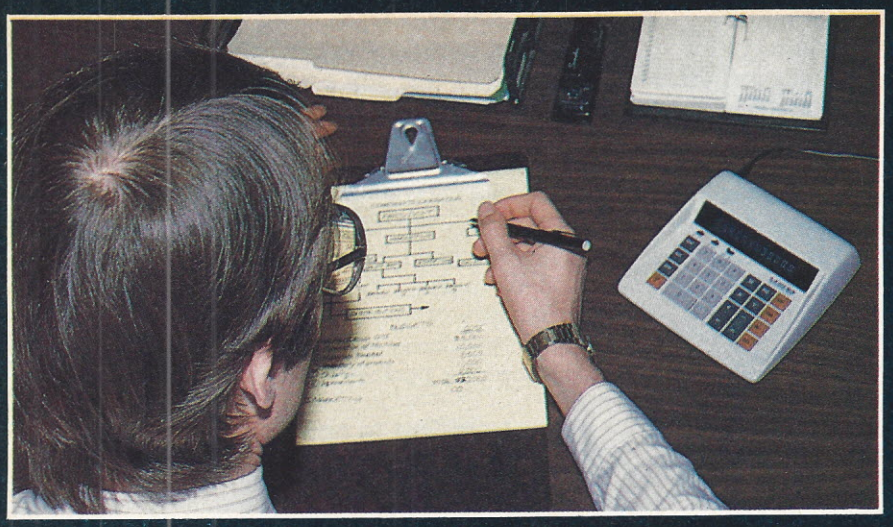
Most micros today are similar in size to terminals used for timesharing. The main difference is that storage media—5-in. or 8-in. floppy disks—must be physically swapped by the micro operator from time to time.

The micro can be a very cost effective piece of equipment. It can be paid for and amortized over only a few years. Several can be purchased to provide backup. Service contracts are available, but often dispensed with. The average small business micro user operates his equipment until failure, then has the unit serviced.

The relative income tax advantages of timesharing, leasing, purchasing, or the use of service bureaus are too complex to cover here. (See article on page 66.) You should investigate the possibility of writing-off all time sharing charges, then compare that net cost with what you will save depreciating an on-site micro, or deducting its lease cost. Investment credits—which may or may not be passed on by the leasing company—should also be considered. There are so many cost factors involved that it is hard to come up with any concrete guidelines. This is especially true in these days of skyrocketing interest rates.

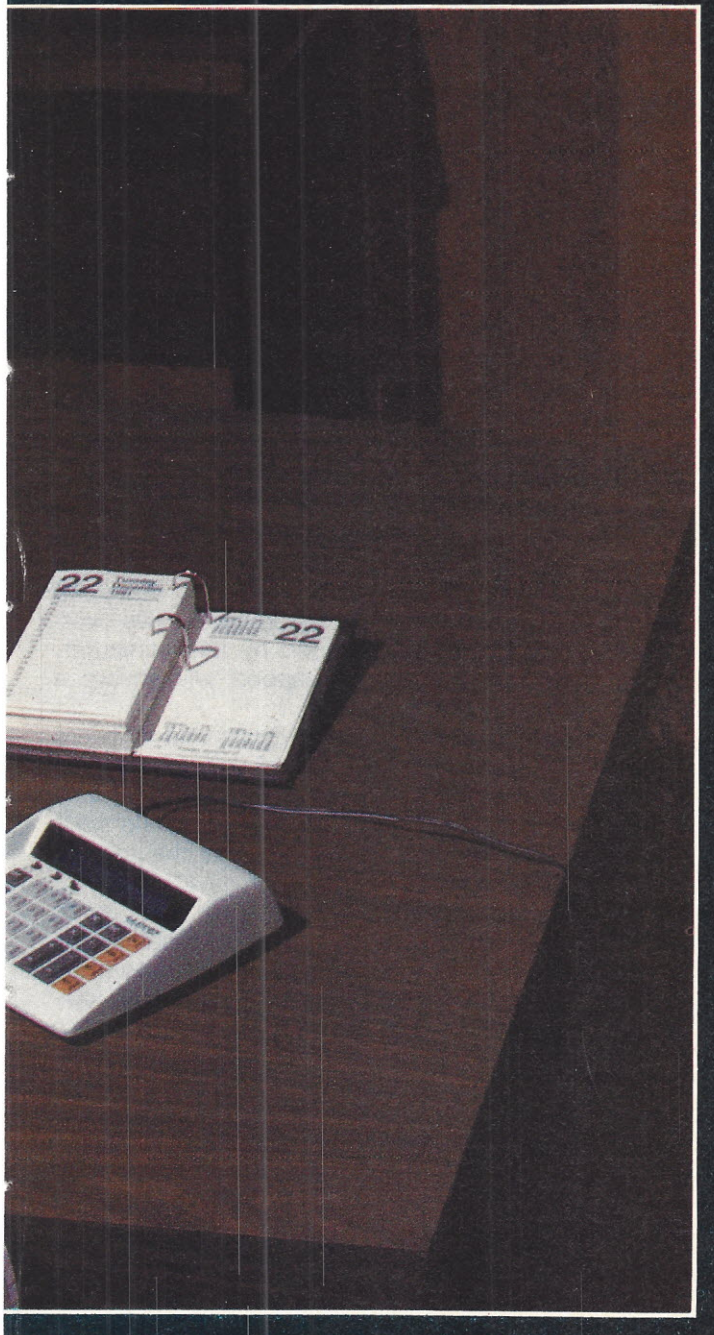
With hard disk units looming on the horizon, and 16 bit computers such as the IBM Personal Computer already on the market, the microcomputer also stacks up favorably against timesharing and the service bureau regarding its capabilities. Strictly speaking, there is little that a mainframe computer can do that a micro cannot. The tradeoffs in time, convenience, and memory storage are such that the Cray-2 and all lesser large scale computers will dominate their portion of the market for a long time to come.

However, a growing number of users are finding that, for the first time, it is practical to have a computer of their own rather than rent a little bit of someone else's. □



WHAT TO DO UNTIL THE COMPUTER COMES

by Rocky Smolin



How many times have you heard this small business tale of woe? "We did have a computer in here for about a year. Spent close to $100,000 on it, too, but we never did get the thing to work right. Finally, we had to get rid of it."

As Winston Churchill said, "Those who refuse to learn the lessons of history are doomed to repeat it." It is my contention that most failures in the attempt to automate come from the inability to foresee the problems to be overcome and the kind of effort and resources needed to overcome them.

Nothing is more disheartening than to have a computer sit around in a business for three or four months not operating or not giving results. Even though there is much work to be done before the system is delivered, the first impulse of most first-time computer users is to get the machine first, then figure out what to do with it.

Many of the most serious problems you will encounter can be anticipated by following the installation planning guide that follows - a plan adapted from the excellent guidebook offered by ASK Computer Services of Los Altos, CA, to its customers, prior to system delivery. The purpose of the guide is to eliminate the "seat-of-pants" approach taken of necessity by most new users of small business systems, who solve the problems one by one as they arise, never knowing whether the solution to one problem is spawning many new ones.

The first step is to define your requirements. Before you call the first vendor, look at the first advertisement or go to your first trade show. Sit down with a blank pad of paper and write down all of the current manual functions done in your office - payables, receivables, inventory, customer mailing lists, shipping procedures, petty cash, everything you can think of. Now rate each of these systems in two ways. First, how is it working today? If it's not doing too well, make some brief notes on what you think the problems are—too much paperwork, inadequate training, clerical error, lack of feedback, inaccurate information, etc.

Now, rerate each system assuming that the size of your business will double in two years. How well do they hold up? What's wrong with them under the increased business activity? Can these problems be solved by altering the manual system?

Study this sheet carefully and ask yourself the $5,000-$100,000 questions: Do I need a computer? Do I really need to automate? Can I solve these problems by upgrading my manual systems and also provide for growth to two or three times my present level? Knowing what you now know about small business systems, your chances of going any further into the realm of data processing are exactly 50-50. If you decide at this point to defer or abandon the project, you just saved yourself a boatload of money and headaches.

If, on the other hand, you conclude that a small business system is the answer, you have probably

A. Computer System

Processor and terminal		$_____
Extra terminals	____@$____	_____
Additional memory	____k	_____
Disk and tape drives:		
Floppies	____@$____/drive	_____
Winchesters	____@$____/drive	_____
Hard disks	____@$____/drive	_____
Cartridge	____@$____/drive	_____
Cassette drive	____@$____/drive	_____
Printers:		
Matrix		_____
Impact		_____
Line		_____
Paper catcher/stand		_____
Cables and connectors		_____
Interface boards		_____
Total hardware		$_____

B. Supplies

Recording media (disks, tapes, etc.)	_____
Stock paper	_____
Forms (invoices, paychecks, etc.)	_____
Total supplies	$_____

C. Furniture

Desk(s), stand, or work station for computer and/or terminal(s)	_____
Chair(s)	_____
Anti-static floor pad(s)	_____
Tape/disk storage	_____
Total furniture	$_____

Figure 1. System Pricing Worksheet: Hardware

Systems:	
Operating system	$_____
Utilities	_____
Applications:	
General ledger	_____
Accounts receivable	_____
Accounts payable	_____
Inventory Control	_____
Payroll	_____
Order entry	_____
Purchasing	_____
Database management system	_____
Custom software	_____
Software modifications	_____
Total software	$_____

Figure 2. System Pricing Worksheet: Software

found the one tool that will enable you to survive your current problems and all the new ones that accrue to a rapidly-growing business.

Using the primal system again, start by making a list of the outputs you would like from the system. They will fall into broad categories covered by the popular business packages - payables, receivables, payroll, etc. In addition to this, you may have a specialized need—something particular to your business that will have to be custom-programmed.

Proceeding around the primal system diagram, try to estimate roughly the sizes of the files you will be storing —how many customers, vendors, outstanding invoices, payables, employees, sales orders, general ledger accounts, transactions-per-month of all types, etc. If you can't tell from this whether you will need mini-floppies, standard floppies, Winchesters, hard disks, or something else, at least you'll have answers to the questions that sales people will ask when trying to determine your storage requirements.

How many terminals?

Inputs will be pretty much limited to terminals. The big question here is: Will you need more than one? If so, the processor must be capable of handling multiple terminals —both the hardware and the operating system.

Next, get a formal price quotation for hardware and software. Getting this done includes the software evaluation procedure outlined earlier. This procedure will cut down on the number of quotations you will get, because you'll be such a pain in the neck that many sales people won't want to bother with you. What you'll be left with are the good systems—the ones the sales people believe in.

Now present the proposal to management. If you are management, present it to your partners or immediate subordinates. Invite participation in this decision. It's a complex and difficult one. More opinions at this point can only help to uncover factors you might have overlooked. Everyone will be affected by this computer. Having their cooperation and support will ensure a successful implementation.

Now you are ready to order hardware and software and establish delivery dates. Try to understand your supplier. This industry is hit sporadically by bad product forecasting, quality-control problems, component shortages, etc. Plan on the possibility that the delivery schedule will be slipped.

If you are having software written for you, try to protect yourself with a performance clause inserted into the contract. I've never seen a piece of customized software delivered on time and bug-free. Your outstanding invoice is the greatest lever you have in making the supplier perform to specifications. In order to avoid conflict over what was specified, the supplier should provide you with complete software specification documentation for you to buy off, before a single line of code is written.

Matching the skills and capabilities of the person to the job to be performed is as important here as it is in any position. If you have gone through the software selection procedure, you have a pretty good idea of how simple or complicated the various procedures are in the software you have chosen. Choose your staff accordingly. Backup in staff is as important as backup

of data. Be sure there is more than one person who knows each part of the operation.

Once the system arrives, the initial implementation steps will require the input of a great deal of data that needs to go in just once - the item master, the name and address files, the current balances on the general ledger accounts, etc. Have the source of all of this data identified and prepare a step-by-step plan for inputting before delivery. Your software supplier should be glad to help you with this task.

Now, enroll operational people in classes. Some vendors offer formal training for their systems. Some will charge a day's on-site consulting fee to talk to your employees about the system and give demonstrations. Plan on this expense when budgeting for your system. It will be money well spent.

Next, gather and edit initial data for the master files. This is an excellent opportunity to do some housecleaning of your files - weed out the old customers and suppliers, check addresses and telephone numbers, etc. You don't want to load up a fresh, clean data base with a bunch of outdated data.

If possible, have your data entered on whatever media your system supports before it is delivered. This is another of those time-consuming tasks that tend to reveal procedural problems, missing data and input bottlenecks. It gives your data entry and operating people a chance to get familiar with the machine and to make mistakes before they really count. If you are converting from another system or a service bureau, you may be able to take this opportunity to get a conversion program written to convert your files from the old system to the new one.

Now, it's time to order pre-printed forms. This is another real schedule slipper. From design to delivery, forms can sometimes take eight to ten weeks. Hopefully, the software people can supply you with samples of pre-printed forms for your invoices, statements, check and stubs, shippers - whatever you are going to have the system print. Try to avoid having to modify the software to fit your forms. Be adaptable. Avoid unnecessary programmer's fees and maintenance problems.

Backup media is important

The next step is to order backup media—lots of it. It's very cheap compared to the total price of your system and even cheaper compared to the cost of re-entering lost data that weren't backed up for lack of media. Also order paper for line printer and hard copy terminals.

Begin using new forms where possible. Roll them into a typewriter and type on them. Employees will become accustomed to using and reading them. Problems with the forms of your manual-support systems may come to the fore, and it will ease the anxiety that always accompanies the transition to automated systems.

Prepare your test data. When your computer first arrives, you will want to check out the operation of the software and train the people who will be using it. You will also have questions from time to time about the effect of a certain operation or the way a program updates a file. Despite the trouble that preparing test data can cause, it pays off many times over after your system is delivered. Either invent some data or use some of your live data to build test data for every file you will be using. This will provide a "no-penalty" place that allows for mistakes and testing of new procedures.

Set aside a place for the computer. It should be in a low-noise, low-traffic area. If it is intended for use by several people for inquiries, make it accessible. Computers are often troubled by the close proximity of telephone switching systems and electrically noisy machinery and appliances. Devices that draw a lot of power upon start-up can cause voltage drops in the AC power line of your machine, causing it to fail. Problems of this type can be overcome by putting an inexpensive line filter between your computer and its AC source. If possible, plug your printer into a different outlet than the processor uses.

Integrated systems generally require at most two outlets, one for the computer and one for the printer. If you are putting together your own components, you may need as many as six outlets. Plan for this by having an outlet strip and as many line filters as necessary on hand.

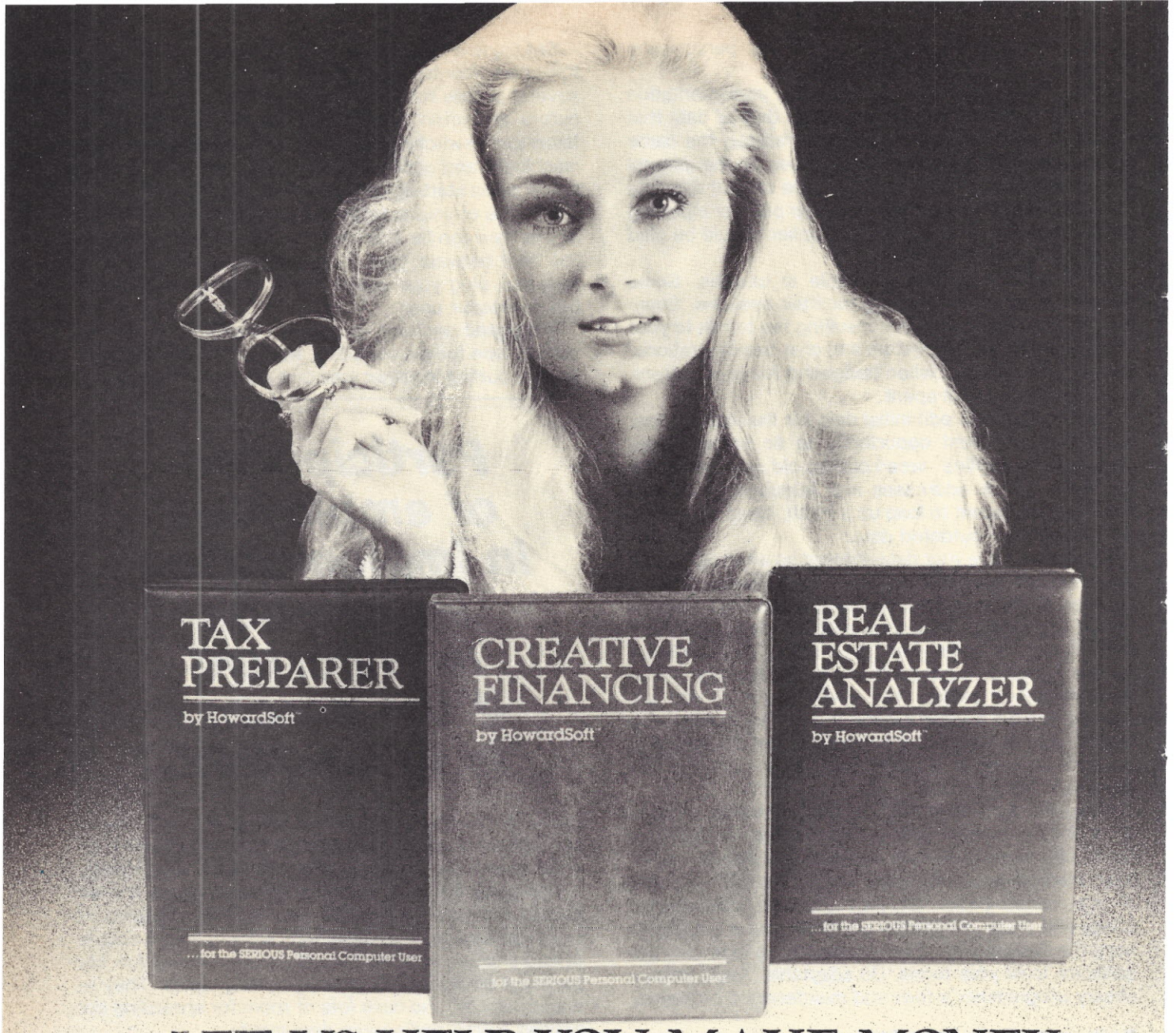
Participation of employees in implementing automation is important if the process is to succeed.

Computer furniture is gaining popularity now. It's not cheap, but you may find it aesthetically pleasing. It would be best to have somebody work at it for a couple of hours to see how comfortable and functional it is. My personal preference is for long folding tables: They're cheap, sturdy, and have lots of room for spreading out printed output and source documents.

Operating a computer requires a high degree of neatness and precision. Make this easy by providing inexpensive accessories like diskette organizers and output binders.

When you accept the delivery of the hardware, examine the shipment. Use the same procedure as for delivery of any fixed sheet. Install and test the hardware. Hopefully, the manufacturer will have provided you with some diagnostic programs to check out the processor, the memory and the printer, in addition to exercising the disks. Otherwise, the only thing you can do is to install and test the software. Use your test data to create small test files - customers, invoices, inventory—whatever systems you are implementing. Run through the entire cycle, checking every program for accuracy and freedom from bugs. If you think it's necessary, type and copy off a bunch of bug reports. Use it to report any bugs or problems to the manufacturer and file a copy for follow-up. You can also use it to document enhancements or changes you would like to see implemented.

To train your staff in the use of software, set up user- and management-demonstration sessions. Nothing is more upsetting to people than to have a computer



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move into the company without being told about it. All the myths about computers taking everyone's job and spying on people are still alive and well. The object of this move is to demystify the computer.

Demonstrate the software to all interested and affected personnel. This is a tough job. Some people won't know what you're talking about. Some will be afraid. Some will be deliberately disruptive. At least one will spend all his time telling you why this system won't work. Try to outline to each department in the company exactly what the computer will do and how they can come to the computer for answers. Give them the feeling that they are *in* control, not *being* controlled.

Establish some operating procedures. The most important procedure is your backup cycle. Impress the operators with the critical nature of this operation. Almost as important are the procedures for inputting data, running reports and updating the files. If you have the time and patience, have the procedures typed and placed in a binder by the computer with the manufacturer's operating manual for reference by the operators.

Train your operators. This should be done on a one-to-one basis. Start with the test data. Check all their work very carefully during the first few live sessions. If they are making a consistent mistake, it's probably due to something you forgot to tell them. The most important thing here is to establish a "no-penalty" atmosphere for your operators—one in which they will be encouraged to ask questions.

Load master files with data, if this has not already been done previous to delivery. Also, load file with the current data—quantities on hand, general ledger, account month-to-date, and year-to-date totals. Running parallel with the old system is extremely important, particularly if your auditors are fussy. More to the point, you'll want some confirmation that your system is operating correctly. If you can handle it, running two full months in parallel is recommended. This will mean some extra work for your people while they are supporting two systems, but if they have been properly prepared, they will understand the need for this. Don't assume that discrepancies between the old and new systems are due to the computer. Many manual systems have been known to be wrong.

When you have run parallel long enough to satisfy yourself that you are not going to destroy your business, discontinue the old system. Then make plans to expand your business.

For almost every business person, automating a small business is a brand new experience. As such, it is obviously not possible to know in advance what procedure to follow, what steps to take and in what order, what details are important and which ones are trivial. In summary, there are two things one can do to minimize the hazards and pitfalls of automating in order to maximize the chances for success and reward—education and planning. By educating yourself, you gain the vocabulary you need to allow fruitful interactions with those in the industry who stand ready to help you. Planning ahead will allow an orderly transition from the manual mode to the more efficient, productive and profitable automated business in your future. □

Adapted, by permission, from Mr. Smolin's book How to Buy the Right Small Business Computer System, *©1981 by John Wiley and Sons, New York.*

Forum on Computer Industry After-Sale Support

The following questionnaire is part of a special project that we are undertaking to offer advice for consumers of microcomputer products.

If responses by our readers result in enough data to form significant conclusions, we will publish the results in an issue later this year. We are hoping that readers who are concerned with the issue of after-sale product support will take the time to answer the questionnaire. For more details on the project and how it evolved, read *Editor's Notebook* on page 6. All responses must be in our office no later than March 31, 1982 to be tabulated. Send the questionnaire to: Consumer Survey, Interface Age, 16704 Marquardt Ave., Cerritos, CA 90701.

1. System manufacturer: _____

2. System model: _____

3. System cost:

	Hardware	Off-the-shelf software	Custom software	Other (training, etc.)
Initial	$	$	$	$
Enhancements to-date	$	$	$	$
Expected in next 12 months	$	$	$	$

4. What is system configuration?

   CPU: _____

   Memory size: _____

   Disk drive size: _____5.25 _____8. _____Hard (how many?)_____

   Disk storage capacity (M bytes): _____

   Terminals: (how many?)_____ Manufacturer _____ Model _____

   Printers: (how many?)_____ Manufacturer _____ Model _____

5. What operating system(s) do you use? _____

6. What language(s) do you use? _____

7. What application software is used? _____

   _____

   _____

   _____

8. Did you purchase anything that you no longer use? _____

   _____

9. If 'yes', is this because: (check one or more)
   It does not work as advertised ☐
   It does not meet the needs (too simple) ☐
   I can't figure out how to use it (too complicated) ☐
   I haven't had time to use it ☐

   Other _____

   _____

10. If you had to make your purchase decision all over again, what hardware component or software package would you choose differently?

    _____

    _____

    Why? _____

    _____

11. Where did you buy your system? Please give address and phone number of your retailer or mail order company.

	Local retailer	Mail order
Hardware system		
Hardware Addition		
Off-the-shelf software		
Supplies and accessories		

12. How would you rate the performance of your retailer during the sales presentation? (circle one)

Local retailer:	excellent	very good	fair	poor	insufficient
Mail order:	excellent	very good	fair	poor	insufficient

13. Did you need after-purchase help from your retailer? _____

    What? _____

    _____

14. If yes, were you satisfied with the help you received? _____

15. How would you rate the after-sales service? (circle one)

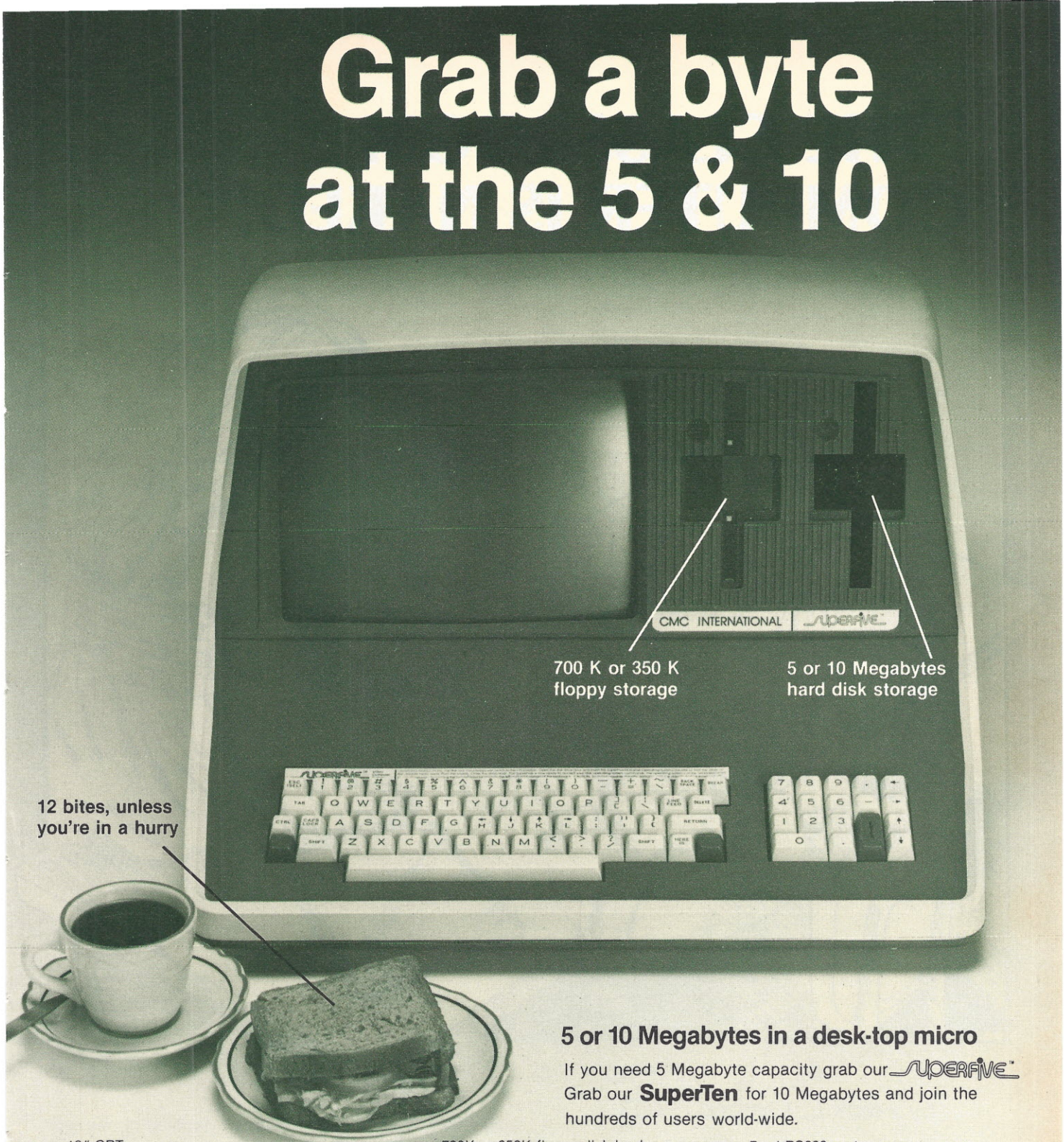
Local Retailer:	excellent	very good	fair	poor	insufficient
Mail order:	excellent	very good	fair	poor	insufficient

16. How do you feel about using software programs for which payment is not made to the 'official' source? (check one or more)
    It is not ethical; I wouldn't do it. ☐
    It is o.k, if the originator doesn't bother to 'protect' the disks, making the program difficult or impossible to copy. ☐
    It is o.k. if the program is overpriced. ☐
    It is o.k. under any circumstance. ☐

    Other: _____

If you wish to add additional comments, include an extra sheet with your questionnaire.

Grab a byte at the 5 & 10



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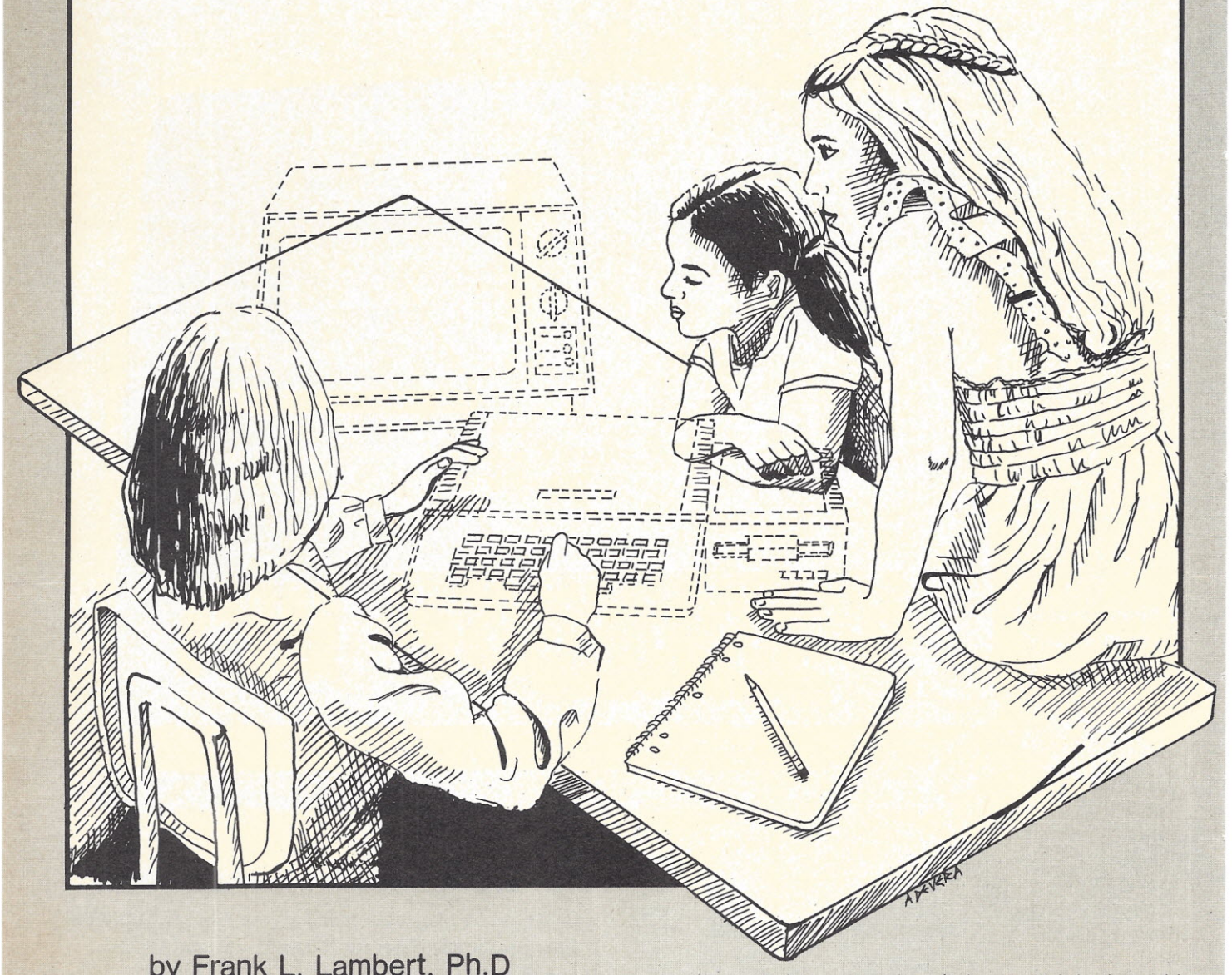
"THE CLASSROOM COMPUTER IS NAKED!"



by Frank L. Lambert, Ph.D

Remember that old story, *The Emperor's New Clothes*, about the little child in the crowd who was the only one brave enough to cry out that the emperor really didn't have any clothes on at all? There is a parallel that can be drawn to the current hysteria over computers in the classroom.

Many teachers of subjects other than computer science have been sold the bill of goods that the microcomputer has finally come of age to help them all—whether in reading or social studies. It hasn't. There is even a 50-50 chance that the use of microcomputers in teaching will be as big a flop as some of the other recent dreams in educational technology proved to be. About 25 years ago, there were books with information, questions and answers in what seemed to be odd arrangements. This "programmed learning" was supposed to revolutionize education. It didn't. There aren't many programmed learning books around any more. Similarly, older educators remember the hope of the 1950s for a dazzling national education television network. That certainly is a vanished dream—as we struggle along with just a few great educational programs on public television. But why might micros follow the same boom-and-bust cycle? Has something happened to the bright predictions of the late 70s for the small computer, or to computer-assisted instruction (CAI) in general?

It seems everything went right at first. In the mid-60s, Professor Suppes and others at Stanford University

developed programs for central computers to give drill and practice in arithmetic for youngsters who shared computer time at teletypes. Even a course in Russian was produced for Stanford undergraduates. The results were impressive in the Russian class: students who used the CAI did much better on exams than conventional-classroom students. In elementary arithmetic, Suppes found that CAI didn't help the young pupils any more than a dedicated teacher. However, CAI certainly delivered good drill sessions across an entire school district with large numbers of students and teachers who had widely varying backgrounds and abilities. Especially important was the discovery that CAI could actually improve youngsters' achievement in less affluent schools where the teachers' training might not be adequate.

Of course, other universities weren't asleep in the 60s. Although university computer time was mostly committed to scientific calculations and teaching about computers, some professors began to use computers in teaching everything from English literature to biology. Beginning in 1960 at the University of Illinois, Dr. Donald Bitzer (with the help of many others, and with $5 million from the National Science Foundation) devoted ten years to developing the elaborate PLATO instructional system on a big computer network. In scores of courses, PLATO students had modern touch-sensitive monitors at their terminals instead of teletypes. They could move a word or a graphic picture around to make sentences or arrange the parts of a chemical apparatus correctly merely by touching the screen. Dartmouth not only put computer terminals all over its campus for use in courses, but even invented a simpler computer language, Basic, that has since sprouted a dozen dialects.

Things looked great for CAI at the universities by the early 70s. Although expensive, it presented excellent drill-and-practice and some complex ideas. Maybe the cost could be offset by the savings in teachers' time.

Why didn't CAI spread?

In the 60s and 70s, dedicated educators in elementary and secondary teaching saw the possibilities of CAI just as clearly as university people. It was even harder for them to get money for equipment; mainframe computers then cost hundreds of thousands of dollars. However, as long ago as 1965, Dr. Sylvia Charp and her associates were developing programs and testing them for students in the public schools of Philadelphia. Other teachers found what Drs. Charp, Suppes and Bitzer had discovered: CAI works. It was most effective in stimulating students in drill and practice, but that didn't mean that it was only useful for drill. By 1974, there were probably over 1,000 instructional computer systems in use for kindergarten through twelfth grade (K-12), with approximately 2,000 terminals.

If CAI worked so well then, why didn't it spread like wildfire to proliferate into 100,000 systems and a million terminals by 1977? Were there problems? There certainly were! Costs were enormous for computer systems. Often, school districts could only justify buying them for administrative and management purposes. Then, elementary and high schools simply shared a minor amount of time on the computer for teaching purposes, while accounting and payroll departments used the system heavily. In universities, the situation was frequently the same: the majority of time was dedicated to administrative uses, scientific calculation or computer science classes; other educational endeavors took what time was left. Timesharing sounds fine and works well on modern 1982 ultra-fast systems, but on older or slower mainframe computers, it killed the best parts of the CAI process.

Much of the magic for a youngster using CAI is his ability to control the system quickly. Push the key and a response appears right away. Give the wrong answer and nobody sighs or laughs. Try again fast and nobody seems to know that you failed the first time. It's a *private* learning machine. That's the way it should be. Yet so often, because writing superior courseware is an arduous process, the basic ideas of Suppes weren't even approached in the school's courseware, much less surpassed. Dumb questions (from a child's viewpoint), poorly organized material (according to the best psychological and learning-process evidence), inadequate prompting, or tutorial aid—these are some of the deadly deficiencies that threatened CAI then, and still do.

CAI's magic for a youngster is his ability to control the system quickly.

The most frequent problem in heavily used timesharing systems is a slower response time as more users come on line. An answer typed at the terminal by a student can take five, ten, thirty seconds or longer, before it appears on the terminal screen if the "downtown" administration and other schools are slowing the computer by their demands. To a fourth-grader, a thirty-second wait with nothing happening on the screen is "I-hate-computers" time. That's no fun at all, and it means that the student is ignored, just as in the worst classroom teaching situation. CAI, under these slow response conditions, becomes non-productive for the student and a waste of the taxpayers' money.

Crashes of the entire computer system are even more unsettling to the educational process for teacher and pupil. Even on many systems today, the teacher's timeshared big computer is often down for a class period or a half-day. Usually, scheduling for use of the computer terminals has to be rather rigid because of a minimal number of terminals for a given group of students. Thus, when a class misses a day or two a month of CAI in such a scheduled curriculum, the whole learning program is upset. Equally important, the youngster loses confidence in the computer as his regular friendly aide. And worst of all, students can't use the computer at any time during the day other than their assigned 10- or 15-minute period! At lunch or before and after school, a tireless computer is ready to help students, but is either pre-empted by administrative bookkeeping or shut down. No wonder youngsters get the feeling that learning is supposed to stop at 3:00 P.M.!

Then in the late 70s came the Miracle of Micros: the introduction of desktop computers with power greater than many so-called big computers of the 60s. They also boasted a cost that was within the range of a PTA fundraiser in middle-class neighborhoods. Many experienced CAI teachers immediately recognized that micros could eliminate most of the old timesharing problems; "downtown" administrative chores would no longer be able to throttle the educational use of computers because there could be one or more micros in many classrooms. Most importantly, they would be under the complete control of the classroom teacher. Dedicated teachers who had no CAI background caught the enthusiasm, but weren't too well versed in computer usage.

Their sincere naivete led computer-wise educators to press the idea that there was country-wide need for computer literacy: a deep understanding of computer functions and programming among teachers and students. (Although such an idea is as debatable as the "need" for automatic transmission expertise among all the millions of car drivers, it has gone almost unchallenged.) This emphasis on computer literacy has led to hundreds of meetings and workshops for teachers, and a comparable volume of articles pushing programming for the beginner. Because of all this, teachers' energies have been diverted from their main mission of using computers to teach subjects other than computer science.

Micro manufacturers and their venture capital backers were delighted by their rapidly rising sales curves in the late 70s. Such a marketing success was literally incredible from a rational viewpoint: computers should be no more salable without a selection of excellent programs than a TV set without any enticing TV programs.

Good courseware is scarce

But micros sold anyway! The secret of the small computer boom was the apparently bottomless market of the hobbyists, augmented by many educators. A true hobbyist would take house payment funds to buy gadgets and ask nothing from the micro manufacturer, other than the chance to send more money for more equipment. Computer literacy educators were equally good and docile customers. All they required was hardware; they saw their mission as not only teaching about the operation of the computer, but also developing the good courseware necessary for computer-assisted education. This was a commendable goal, but it was not realistic. Writing excellent programs for education requires years of experience in programming, educational expertise, and many author-years in perfecting the courseware. Few, if any, teachers have the time, ability or energy to carry on the two demanding careers of teaching and programming. Thus, it is no surprise that one result of the computer literacy emphasis has been the production of thousands of mediocre educational programs. An even more serious result has been the consequent failure of educators to unite in putting economic pressure on manufacturers and publishers to produce superior courseware for micros.

Of course, micro manufacturers were vaguely aware of the sales potential in educational applications and the need to do something to cultivate such customers. Still, manufacturers' strategies to meet the desires of educators and concerned parents were literally amazing in their ineptitude. Setting up foundations to give away small computers so teachers could develop their amateur programs hurriedly, or announcing prize contests for programs that combine graphics and music are certainly not effective ways to create software that will sell a million micros. If some valuable courseware has resulted from these efforts, it is primarily due to the remarkable ingenuity of teachers who will overcome any obstacle to help their pupils.

Large timesharing systems have proven useful for education, but they are costly and far from perfect teaching aids. The miracle of the micros sounds great until an overloaded teacher says to the micro sales representative: "Fine. In ten minutes, show me how your black box will aid my American history class tomorrow morning." Then the snow job begins.

Hardware is improving

On the positive side, hardware is becoming better in all aspects, from reliability and sheer memory capacity to sophisticated, personalizing touches such as voice response. Small computers can be purchased today that have enormous educational power. With their vast memories, augmented by hard disks, they can not only employ complex graphics and sound, but control the display of material from videotapes and videodiscs. Thus, an attractive, dynamic teaching device is here in which the student is presented information, can respond to questions, work on problems, ask for additional help, refer back to video or computer memory sources, then proceed interactively. Presentation of information, drill, enrichment, simulation—the whole range of computer instructions with sound and color—is available now, delivered on small units for the individual classroom.

Yet, the wise teacher and concerned parent will buy a computer only if they can get a turnkey operation, the whole package: hardware *plus complete, superior courseware*. No matter how powerful the computer hardware may be, it is wasted without equally extensive, attractive courseware.

Most elementary school teachers are deeply concerned about their pupils' progress, have a high pupil-to-teacher ratio, and consequently are overloaded with work. They do not have the time to evaluate dozens of short programs. A teacher needs those dozens of little programs combined into one unified whole, i.e., courseware that could be called major courseware that covers several years of instruction in a subject. With this major courseware, the teacher can handle several levels of pupil achievement in any class of students. What high-grade major courseware (as contrasted to short, single-concept programs) is available for a teacher's rapid evaluation? The prospect is grim, unless one is satisfied with 1977 utilization of 1982 hardware. The hand-held Little Professor was introduced in 1976. Should powerful computers help a teacher only that much in a 1982 classroom?

Few programs even make decent use of animation, color and sound. Many drill programs display a smiling face on the monitor screen after the student has typed in a correct answer, but the same, "happy" face appears again and again at every correct answer. The intelligent youngster has been known to give the wrong answer just to get some variety—perhaps a crying face with animated tears—because this is more interesting than

the gratuitous "reward." What a misuse of the power of a computer! At least six reinforcing responses could have been randomly introduced for rewards without straining any memory capacity. The courseware writers have neither used their imagination in developing the program, nor have they adequately tested their product to check its performance in actual classroom use.

For another example, wrong answers in drill problems are often signalled by a beep sound that cannot be turned off on some computers. Unless the youngster is alone, this is an anti-learning device that hinders his interaction with the computer; if classmates hear the negative response, they know that "Mary has missed again!" Much more serious is the common display of some phrase like "Try Again, Mary!" for an incorrect response, without giving the student any hint as to what kind of error occurred. Thus, the next try—assuming the cause of error wasn't obvious to the student—has to be a guess. In courseware written this way, the powerful tutorial aspect of CAI has been ignored, undoubtedly because it takes more time, effort, money and memory to write courseware that aids instruction. These are simply a few samples of less-than-helpful bits in relatively good major programs. However, teachers have enough problems without discovering that their arithmetic courseware displays at the bottom of the screen, "Type Yes or No" when a numerical answer is called for by the problem.

This does not mean that a teacher or concerned parent should not buy a small computer now for educational purposes. For example, the math teacher with slow pupils whould be immediately aided in drilling each pupil by microcomputer, peripherals and B-grade courseware now on the market. More rapid student progress can be almost guaranteed. The best courseware would include a management system that reports on the results of each pupil's session at the terminal, including the difficult points. Similarly, a parent who has a child with special problems in reading, spelling or arithmetic certainly would find significant help for the child, even using the B-grade programs currently available.

The warning is simply this: No one should buy a computer and accessories for education without thoroughly examining the courseware. An administrator not intimately acquainted with the teaching of the class cannot be trusted to buy courseware for the actual user-teacher. Advice from administrators, fellow teachers and magazines can be helpful and time-saving, but the user must be the ultimate judge. Microcomputers are gathering dust in teachers' closets all over the country, and others are being used only for non-educational games, simply because they were purchased as the magic answer to teaching problems—often without any courseware! In 1982, courseware is the *only* magic. It is the first consideration in computer-assisted instruction. Any dealer can supply the small computer and accessories to handle the programs, after the best possible courseware has been chosen.

Developing superior courseware is a prerequisite. However, carrying it out isn't easy. One way that it shouldn't be done is by individual teachers working alone on small programs or in small groups on big programs—this has been done for several years with only marginal results. Yet, that is exactly what the big

educational marketers in the country are urging teachers to do right now. In essence, they are saying "Buy our small computers and our great program-writing guides and you'll revolutionize education in your classroom." This sales pitch will only result in teachers discovering how much work it is to write good programs, hiding the micro in the closet, and becoming totally disillusioned with CAI.

There is really only one way to create superb courseware. Drawing on all the past experience of similar workers, a good-sized group of high-ability, high-paid programmers and educators must work full-time in an environment that provides maximal support for information-gathering and complex program writing. The completed programs must then be tested and revised again and again in actual teaching situations. This is probably very close to IBM's business-programming practices and military program-writing, where money is no object. It simply hasn't been done yet in the education field because of the required investment. One education-publishing company is reported to have had its courseware programmed by a 13-year-old working in his garage, and the resulting program bears this out. In 1981, another major publisher put small ads in computer magazines desperately asking any educator interested in testing educational programs to write; this is hardly a professional approach to courseware testing.

The educational market is potentially huge, with a possibility of tens of thousands of micro + courseware packages in schools and millions in middle-class homes. If millions of dollars in courseware sales are possible, why haven't the educational publishers risked the capital needed to put together top-flight teams of programmers and educators to produce excellent courseware? The basic answer is ethically depressing: supposedly respectable teachers openly steal for supposedly respectable educational purposes. Many teachers have duplicated copyrighted disks for their own classes, and classes in other schools in their district. This kind of stealing is catastrophic to the rightful profits of the publisher who has risked capital in developing software. Unless copyproof techniques can be devised for courseware on disks, there is little chance that truly superior courseware will be developed for the general educational market.

Courseware to the home via telephone

Fortunately, there are two possible solutions to the dilemma that do not depend upon copyproofing disk materials. The first may be economically difficult at first, but it offers the possibility of a broad, endless market for the entrepreneurs who pioneer in it. Most parents are concerned about their children's education. In past years, parents have made considerable financial sacrifice to send their children to good schools and buy them encyclopedias and other aids. They probably would make similar financial commitments for computers and modems if attractive courseware was delivered to the home inexpensively via telephone. Today, for a nominal hourly fee, two national networks can be accessed on many local telephone lines using standard small computers with modems. The hardware thus exists for a child in the home to turn on his micro, type the local phone number and, for example, ask for the day's homework in fourth grade spelling. The

program that might originate on large computers 1,000 miles away could then proceed with questions, and the youngster could respond. With the lesson finished, the micro could be logged off, or the student could proceed to another subject. Of course, the same procedure could be used in classrooms, but only one network is inexpensive during the day.

A national network would have its software mounted only at the central headquarters on large computers. Thus, because the programs could not be stolen and a small royalty would accrue to the program developer, publishers might put capital into producing software for such a network's central computer.

Videodisks and small computers

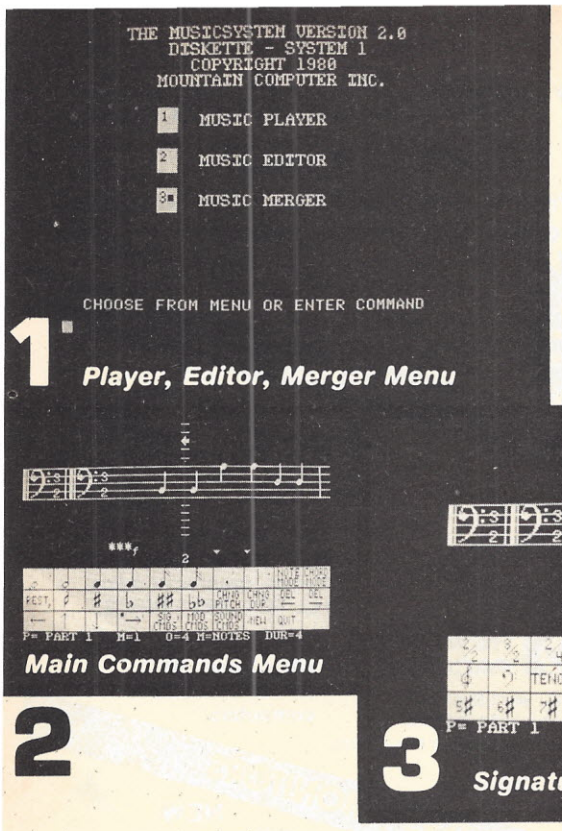
The second solution for protection of valuable courseware is probably more feasible because it fits immediately on present and future systems. The greatest educational potential for small computers lies in their mixed-media use with videodisks. (Video*tape* interfacing is much slower and inferior in single-frame indexing and single-frame clarity.) Today's children are conditioned by brilliant television images. They expect the best. No toddler who has seen Big Bird in action is really satisfied with a yellow-feathered creature on "high-resolution" animation from a micro program. Videodisk pictures and action are perfect complements for the microcomputer's capability for interactive question-answer sessions at the keyboard. Interfacing of videodisks with small computers has been extensively studied at many institutions, notably Utah State University, and is rapidly being developed for numerous industrial-training programs. It can be done; excellent courseware that calls on the whole spectrum of technical devices from audiotape to movie film clips and television-derived information (all mounted on videodisk) becomes possible.

To develop really superb courseware in the micro-videodisk format would be costly, but the investment could be recouped quickly and without fear of theft. The format would be far more acceptable to any user than computer-only courseware, because of the attractive images on the color monitor and the large amounts of information that can be quickly called up by the computer from the videodisk. Therefore, parent and teacher approval should drive the market to sales as exponential as the original micro sales curves.

A large capital investment in courseware would be safe since videodisks (especially laser-read models) cannot be cheaply copied. The major videodisk-player manufacturer spent $20,000,000 in advertising a product for three months during 1981 and sold only about 50,000 units. Probably less than one million dollars would have produced a complete tested micro-videodisk package with excerpts from *Sesame Street* to teach preschoolers the alphabet and numbers. And this is but the first of hundreds of possible courseware offerings in education with the micro-videodisk format.

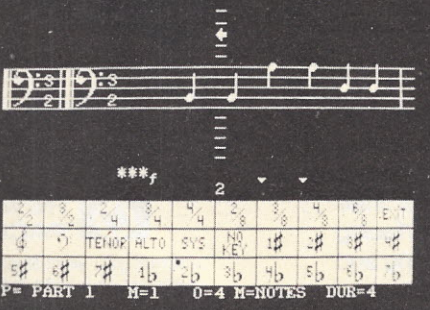
If capital can flow toward development of top-grade computer-controlled videodisk courseware, the future of computer assisted education may be as bright as the brochures and articles have promised. In fact, it will be even better because home use of small computers will not be just games and checkbook balancing. It will be an exciting mix of education via the screen and keyboard —from art to zoology.□

The Mountain Music System

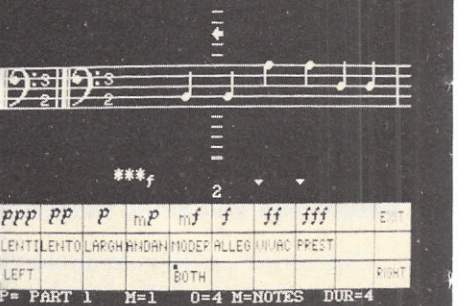


1 *Player, Editor, Merger Menu*

2 *Main Commands Menu*



3 *Signature Commands Menu*



4 *Sound Control Menu*

by Bob DeFord

I reached out and pressed the RETURN key on my Apple computer. A moment later, the room was rocked by a thundering bass note. Cymbals crashed and a trumpet blew a burst of fanfare. A piano began to play an intricate melody. I nodded my head in satisfaction; it was my music, every note of it.

I glanced around the room and saw looks of amazement on my friends' faces. They were surprised that someone who couldn't play a musical instrument could write music like this and get a computer to play it. A few minutes later, the music ended and I had to answer a round of excited questions. How did the computer make the realistic sounds of all those instruments? Would it play other songs? Could they write music on the Apple?

The introduction of another music system for the Apple computer doesn't usually stir up very much excitement because there must be at least eight currently on the market. But the Music System by Mountain Computer, Scotts Valley, CA, deserves a closer look.

This system (probably the most expensive at $500) offers a lot to the Apple owner. The Music System (version 2.0) comes with two system disks containing Editor, Player, Merger, and Instrument Definer programs. It consists of two PCBs with a light pen, and runs on a 48K Apple II Plus with one disk drive. The system uses any external stereo amplifier and speakers, with D/A conversion and additive synthesis to produce sounds. The package comes with 10 predefined instruments, allowing the user to create additional instruments, real or imagined. It plays up to 16 notes simultaneously, from up to 16 independent melodies and instruments. It also allows the user to compose and edit music right on the Apple screen, using standard sheet music notation. The system allows the merging of several small compositions into one large composition. Finally, the unit prints compositions on a graphics printer in standard sheet music notation.

The documentation is among the best to be found with an Apple accessory. The manual consists of over 200 pages of useful, well-written information. Step-by-step tutorial presentations are accompanied by detailed reference sections on each program. In addition, there is a detailed theory of operation for the hardware and information about music synthesis and theory.

The menu shown in photo 1 appears when the Apple is booted with System Disk 1. Large blocks of reverse video indicate the available menu options in this and all other menus. You may use the light pen, the keyboard or the game paddles to make selections.

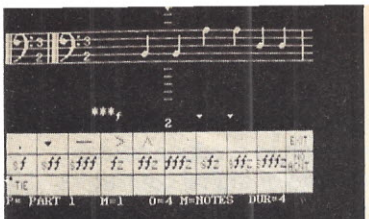
To use the light pen, one must touch the pen to the reverse video block. To use the key board, it is necessary to type the option code. But to use the game paddles, all one must do is rotate paddle 1, which moves the little black square (shown in the MUSIC MERGE option in photo 1) to the option desired and push the paddle button.

Editing and composing are possible

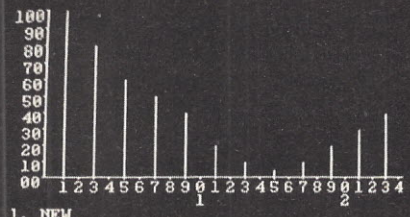
The Music Editor is used to edit existing compositions and write new ones. Access is via the boot menu shown in photo 1. After a few seconds of loading, the Main Commands Menu (photo 2) appears on the screen.

In the status line below the menu, the "P=" tells which part of the composition is shown on the staff and the "M=" tells which measure. This information is necessary because any given composition can consist of 16 independent parts, each with its own melody, instrument, speaker assignment, etc.

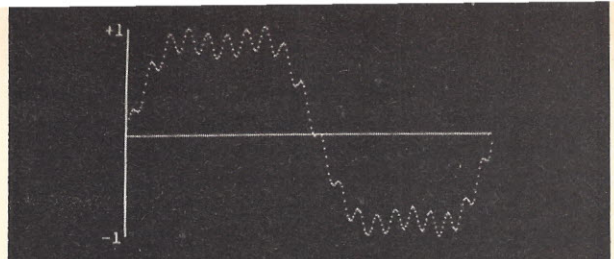
At the start of a new composition, or prior to loading an old one, an empty staff with an editing cursor appears above the menu. The editing cursor consists of a vertical column of short horizontal lines and a solid white arrow.



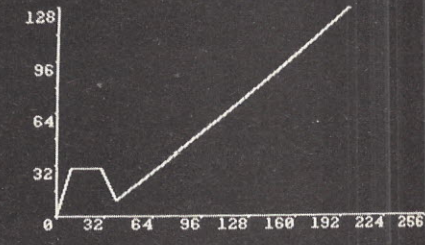
5 ***Note Modifier Menu***



6 ***Harmonic Content of a Waveform***



7 ***Plot of a Waveform***



8 ***Amplitude History for an Oscillator***

In photo 2, the editing cursor appears between the first and second notes in a measure of music from one of my old compositions.

To begin writing the measure, I used the SIG CMDS option on the Main Commands Menu to place the Signature Commands Menu (shown in photo 3) on the screen.

I used this menu to select the clef and the time signature. I could have chosen one of the 14 keys available instead of leaving the measure in the key of C. The NO KEY option would have deleted a previously selected key. The EXIT option returned me to the Main Commands Menu.

To continue, I assigned the instrument for this part by typing the name of the instrument on the keyboard and pressing the RETURN key. I could have assigned any one of the 10 predefined instruments that came with the system, or I could have invented an instrument of my own prior to this edit session and assigned it to play a melody. I chose the predefined String Bass this time because I was writing the melody in the second octave. The Editor stored the name of the instrument in the first asterisk below the music staff.

All instruments can play in the full range of octaves available on the piano keyboard, but some sound like more than one kind of instrument. The Brass, for example, can sound like anything from a trumpet to a tuba, depending upon which octave it is played in. Others, such as my invention, the Brapper, sound like nothing you've ever heard before.

After making the instrument assignment, I selected the SOUND CMDS option from the Main Commands Menu, and the Sound Control Menu (shown in photo 4) appeared on the screen.

Using the options on this menu, I selected the speaker I wanted this melody to play out of, the volume at which I wanted it to play, and the tempo I wanted for the composition. Both the volume for any instrument and the tempo for the composition can change at any time in the composition, but the speaker assignment must remain as it is set at the beginning of each part. The EXIT option returned me to the Main Commands Menu.

Entering notes for this menu is easy. To get started, I used paddle 1 to select the NOTE MODE option. Still using paddle 1, I set the note duration to 4 by moving the menu cursor to the picture of the quarter note and pressing the button. The editor updated the status line to show each decision as I made it.

Since the duration remains set until changed, all I had to do now was select the pitch for each quarter note I wanted to enter. I selected the pitch by rotating paddle 0, which moved the little white arrow in the editing cursor. When I pressed the button, the Editor drew the note on the staff and advanced the cursor to the next position automatically. I continued selecting pitch and writing notes until the measure was full.

When it was full, I had to switch back to paddle 1 and select the Measure Bar (vertical line). This Editor does not automatically insert the measure bar as some do. Since I am not very good at adding fractions, this deficiency has caused me a lot of trouble. I have learned to live with the situation, however, and my arithmetic has improved.

Now I was ready to place the accents on the third and fourth notes to indicate that I wanted them played in a staccattissimo manner. I put these accents on the notes by moving the cursor to the right of each one, then selecting the MOD CMDS option from the Main Menu. As soon as I made this selection, the Note Modifier Menu (photo #5) appeared on the screen. I chose the accent I wanted from the five available: staccato, staccatissimo, tenuto, percussive, and maximum percussive. The ability to assign these accents to individual notes allows the Music Player program to produce a very human-sounding performance.

I could have chosen to tie two notes together or delete an accent from this menu also. The other options shown involve dynamic accents and are not implemented in the Version 2.0 Music Player.

By now, you should have a good idea of how music is written with the Editor program. I went on to write six additional measures of music and add three more parts to the composition. Each had seven measures also. This just about filled up the 48K of memory on my Apple, so I saved the composition on a floppy disk. This composition was destined to be one of nine compositions that I joined together with the Music Merger to create one large composition. This merging is possible because the player program can perform much longer compositions than the edit program can write or edit.

The Edit program has some additional capabilities. When I wrote the measure, I used nothing but quarter notes, but I could have changed the duration as often as I wanted. In addition, I could have dotted any note or placed a rest of any duration at any point in the melody. Similarly, I could have added accidentals (sharps, flats, naturals) to any of the notes.

In addition to writing music, the edit program allows you to edit the compositions you have written. Editing can be done before or after the composition is stored on disk. Notice that there are several edit options available on the Main Commands Menu. These options function as follows:

- The Left and Right Arrows move the cursor backward and forward in the melody.
- The DEL Left and DEL Right Arrows delete the musical event (note, measure bar, rest, etc.)to the left and right of the cursor.
- The CHNG PITCH and CHNG DUR options change the pitch or duration of the note to the left of the cursor.
- A GOTO command, available from the keyboard, allows rapid movement to the beginning of any measure.
- The CHORD MODE allows chords to be written.
- The Up and Down Arrows allow vertical scrolling from part to part in a multi-part composition.

Because the Up and Down Arrows move to the same moment in time in each part, they are the only way I've found to ensure that all my instruments are synchronized correctly when the composition is played back.

In addition to these features, the Editor has a print routine that will print compositions on a graphics printer.

The Music Player program can load any composition from disk. When it does this, it compiles the composition to create a play file and attaches the instrument definitions to that play file. It can change the instrument or speaker assignments for any of the parts and save the results on disk. This allows several versions of the same music to exist - each version played by different instruments.

When the Player plays a composition, the results come out of two jacks on the rear of the Apple. These two outputs act as inputs to the power amp on the hi-fi.

The sounds produced are free of noise or distortion. You will enjoy the wide dynamic range available and the total freedom from sound degeneration due to dirt, background hiss or other annoyances associated with analog recordings.

The Merger program can combine an indefinite number of small compositions into one large composition. The only limit to this process is the amount of memory on the 48K Apple. The Merger program can also copy a composition from one disk to another.

Since the Music System is the only Apple synthesizer on the market to use D/A conversion to produce sounds, a brief introduction to the concepts of digital oscillators and additive synthesis is in order. I am going to be very brief and not try to duplicate the extensive theory presented in the manual.

The concept of digital-to-analog conversion is not new. All D/A converters take a digital number (sample) and produce a voltage that is proportional to that sample. If the digital numbers fed to a D/A converter arrive at a fast enough rate (sample rate), the output can approximate an analog waveform. The accuracy of this approximation is limited mainly by the linearity of the converter and the sample rate. Filtering of the output can also improve accuracy.

All that is necessary to create a digital oscillator is a D/A converter and a table of digital data that describes the waveform desired. When the data is fed to the D/A converter at an appropriate rate, the filtered output of the converter can be indistinguishable from an analog oscillator, such as a musical instrument.

Additive synthesis refers to a peculiar property of periodic waveforms. Simply stated, any periodic waveform may be described as a sum of simpler harmonically related waves. A technique called analysis can be used to find the component harmonics, along with their amplitudes and phases. The various components can then be summed to create a waveform table that describes the periodic waveform digitally. Photo 6 shows the harmonic content of a periodic waveform. On this graph, the vertical axis indicates relative amplitude and the horizontal axis indicates the harmonic frequencies as multiples of the fundamental. Photo 7 shows a plot of the waveform table that is the result of summing the harmonics, in phase, and at the relative amplitudes shown in photo 6. This is one way to create a waveform table for a digital oscillator.

Sixteen voices possible

There are 16 digital oscillators in the system. Each can use a different waveform table and any number of them can be combined to create a given instrument sound. In general, only one, two - or at the most three - oscillators are needed to create the sound of an instrument. This places a limit on how many notes can be played at the same time by the system. In most compositions, I have ended up with only four to six simultaneous notes because of my choice of instruments. But each oscillator can produce the sound of an instrument. Therefore, it is possible to have 16 independent voices. These voices would probably lack some of the richness of multi-oscillator instruments, however.

The Instrument Definer program, on System Disk 2, provides a way to create the necessary waveform tables and combine digital oscillators to create musical instruments. The unique combination of waveforms, oscillators and other data is called an instrument definition. The process of creating an instrument need only be done once; thereafter, you only have to write notes for it. The following paragraphs explain how an instrument definition is made.

The first step in creating an instrument definition is to create a waveform for each digital oscillator. The

process is made simple by a program within the Instrument Definer called the Wavemaker. The photos used in the Theory Of Operation were taken as I used the Wavemaker routine within the Instrument Definer. The waveform shown was one of three I used to create an instrument. The Wavemaker is very easy to use and provides hours of fun. You can add or subtract harmonics of various amplitudes, plot the results and hear each change you make.

In addition to making a waveform for each digital oscillator, you have to make an amplitude history. This history can have up to 15 points in it. Photo 8 shows one of my amplitude histories. The vertical axis is amplitude and the horizontal axis is time. This history governs the loudness of that oscillator during the duration of a note and is easily produced with one of the routines in the Instrument Definer program.

Several other parameters control each digital oscillator within an instrument definition. Each parameter is quick and easy to define, with the routines built into the Instrument Definer program. These parameters are:

- A frequency history of up to 15 points, which can shift the tone of an oscillator during the note;
- an oscillator weight in relation to the other oscillators in the definition;
- An exponential decay factor;
- A waveform name.

In addition to these parameters that apply to each oscillator within an instrument, there are three global parameters for each instrument that affect all oscillators within an instrument. They are: Attack time; Decay time; and Log verses Linear rate of Attack/Decay.

Using the Instrument Definer is made simple by two things. There is a good tutorial, and audio feedback is present during every step. It may drive your family crazy, but each time you make a change to a waveform, oscillator or instrument, you get to hear the results of that change as you make it.

The Instrument Definer will either provide a default melody or will play any melody you desire from your composition file during this feedback. It will even transpose this melody to any octave you want. This allows you to hear what your new instrument sounds like at different octaves. The results of transposition can be amazing.

One time, when I had a big drum sound booming away with the feeling of taut leather vibrating, I decided to hear what this drum would sound like in a higher octave. I was expecting something like a bongo drum and was surprised to hear a banjo!

One handy feature of the Instrument Definer program is its ability to analyze the predefined instrument definitions supplied by the company. Careful study of how the results were achieved has enabled me to work wonders. Using this study and some blind luck, I've created several instruments, including bagpipe, accordion, drum/banjo, reedpipe, brapper and various unnamed creations of rare beauty.

After three months of use, I found the Music System easy to use and free from bugs. The range of sounds and the flexibility of the system make it worth the investment. Furthermore, the system has made me believe that Computer Assisted Music Composition And Performance will eventually do for music composition what word processing has done for writing. □

Writing Off Real Estate Under the New Tax Act

by Dale A. Whitman

One of the major attractions that rental real estate has to investors is the creation of tax shelters through depreciation deductions. In principle, depreciation represents annual amounts of loss resulting from the fact that a capital asset is growing old and will eventually have to be replaced. Property owners can offset these deductions against their other income, often dramatically reducing their tax liability.

The Economic Recovery Tax Act of 1981 (enacted August 31, 1981) makes major changes in depreciation methods applicable to real estate, and makes it even more desirable as a tax shelter. However, existing computer programs for figuring depreciation schedules are now almost entirely obsolete. The accompanying real estate program is based on the new act and discusses some of the important changes it makes in the law.

Perhaps the most surprising change is the virtual disappearance of the term "depreciation" from the Internal Revenue Code. Instead, the new act speaks of "cost recovery," although the basic concept is certainly the same. For years, everyone has recognized that the depreciation deductions allowed by law were often far larger than any actual depreciation in the value of the property in question; indeed, with real estate, market values frequently appreciated at the same time the owners claimed depreciation deductions. The new act's change in terminology simply recognizes that the deductions are not expected to have any relevance to real market condition, but amount to a rather artificial way of encouraging investment in certain types of property.

Under the new act, two basic methods can be used with real estate. The first is part of a larger set of rules called the Accelerated Cost Recovery System, which apply to both real estate and personal property, such as equipment. A.C.R.S. assigns a 15-year useful life to nearly all real estate. This change is of immense importance, since under prior law the taxpayer was expected to base his depreciation deductions on an estimate of the property's actual useful life. Most buildings, particularly those newly constructed, were thought to have lives in the 30-50 year range, but the matter was often hotly contested between taxpayers and the government. Since shorter useful lives produce larger deductions, the change to a 15-year standard both simplifies the administration of the income tax and benefits most rental property owners.

The method of cost recovery under A.C.R.S. is essentially the 175% declining balance method, with an automatic change to the straight line method during the year (generally the 10th year of the property's life) in which it gives rise to a larger deduction. In brief, the declining balance method works as follows: Each year, the taxpayer takes a deduction that is computed as some multiple of "straight line" recovery. But the percentage is applied to the original cost basis only in the first year; in subsequent years it is applied to the declining balance of the basis, after subtracting from that balance the deductions claimed in the prior years.

An illustration may be helpful. Suppose a building is placed in service on January 1, 1983 and has an original cost basis of $100,000. A 15-year straight-line recovery would give rise to an annual deduction of $100,000 by 1/15, or $6,667. The 175% declining balance method would multiply the 1/15 factor by 175%, giving a percentage of 11.667%. Hence, for the first year (1983), the deduction would be 11.667% by $100,000, or $11,667. For the second year (1984), the building's basis balance would be reduced by the first year's recovery, and hence would be $100,000 – $11,667, or $88,333. The same percentage factor, 11.667%, would be applied to this new basis, giving a deduction for 1984 of 11.667% by $88,333, or $10,306. The same procedure would be followed for each successive year.

The nature of the declining balance method is to give relatively large deductions in the early years and lower ones in later years. At some point, the deduction actually falls below the figure that one would obtain using straight-line recovery for the same basis balance and remaining life. Pre-existing law permitted taxpayers to shift to the straight-line method at this point, and the new A.C.R.S. approach does so automatically.

The prior law made the distinction between residential rental property and nonresidential property (allowing a 200% declining balance for the former and 150% declining balance for the latter in the case of new buildings), but this difference is no longer followed. However, low-income subsidized housing is given the special advantage under the new A.C.R.S. method of using the 200% declining balance method, again changing automatically to straight-line when it becomes more advantageous.

Advantages of straight-line method

A.C.R.S. is not the only approach that owners of rental property can use. As an alternative, they may take simple straight-line cost recovery over 15, 35 or 45 years. This approach will obviously give rise to smaller deductions in the early years, even with a 15-year life. However, the new act gives a substantial advantage to taxpayers who use the straight-line method.

To see how this advantage works, consider the tax position of a property owner who purchases a building in 1982 for $100,000, holds it for 10 years, then sells it for $80,000. The sale will give rise to a gain on which tax must be paid. In essence, the gain is calculated by subtracting the adjusted basis of the building from the selling price. Of course, the adjusted basis will depend on the method of cost recovery the taxpayer has been using. Considering the accompanying sample runs, the adjusted basis at the end of 1991 will be $25,000 if the 175% declining balance A.C.R.S. approach was used, and $33,333 if the straight-line method was employed. Upon a sale of the building for $80,000, the A.C.R.S. taxpayer will have a gain of

$80,000
– 25,000
= 55,000 GAIN

A similar calculation for the straight-line taxpayer shows that his gain will be only $46,667.

Of course, the A.C.R.S. taxpayer has received significantly larger deductions during the 10-year holding period, and may consider the larger tax upon the sale to be well worth paying in return for that benefit. In effect, it is like an interest-free loan from the government. Moreover, the sale of a building that was held for investment or the production of income was classically regarded as producing a capital gain rather than ordinary income, and thus as being taxed at the traditionally lower capital gain rates. In recent years, and continuing under the new act, capital gains are in essence taxed at only 40% of the taxpayer's marginal ordinary income rate. Thus, the "interest-free loan" could, in effect, be paid off at a large discount. This latter advantage was particularly troubling to Congress, and in 1969 it first enacted provisions requiring that some part of the gain be "recaptured," or treated as ordinary income, rather than as capital.

Without tracing the torturous history of the recapture concept since 1969, let us see how the new act handles it. For taxpayers who use the A.C.R.S. method, a distinction is made between residential and nonresidential rental property. Nonresidential property receives the harsher treatment; the act requires that all gain realized on its sale be treated as ordinary income, up to the full amount of the cost recovery deductions taken. In our example above, therefore, the entire $55,000 gain would be ordinary income. Note that if a higher price had been obtained, so that the gain exceeded $75,000, only the first $75,000 would have been ordinary income.

Residential property receives more favorable treatment; the gain is recaptured, or deemed ordinary income, only to the extent that the deductions taken exceed those that would have been taken on a 15-year straight-line method. Since A.C.R.S. resulted in $75,000 of deductions in our example, while 15-year straight-line would have produced $66,667 in deductions, only the difference ($8,333) is recaptured as ordinary income. Hence, of the total $55,000 gain, $8,333 is ordinary income and the remaining $46,667 is capital.

By far the most favorable treatment of gain on sale is given to taxpayers who use a straight-line method of cost recovery. They are entirely exempted from recapture; thus, their gain is treated as fully capital. This rule applies whether their property is residential or not. For this reason, a taxpayer, particularly with respect to nonresidential property, might quite rationally decide to use 15-year straight-line rather than 15-year A.C.R.S. cost recovery despite its considerably smaller early year deductions. The "right" answer for a particular taxpayer

depends on his or her marginal bracket and expectations about the time the property will be sold, but straight-line is potentially quite attractive in some cases.

Of course, only buildings and other improvements give rise to cost recovery deductions; the land itself was not depreciable under prior law, and this continues to be the case. In addition, one favorite technique real estate investors formerly used is no longer available: "component depreciation," under which such items in a building as the elevators, roof, and electrical system could be treated as separate pieces of property and separately depreciated, usually based on useful lives much shorter than that of the building shell. The new act requires instead that "composite" treatment of the whole structure be employed, except in certain unusual cases, such as where there has been a major renovation or addition to the building. One further change should be mentioned. It is no longer necessary to reduce the building's basis by its presumed salvage value before computing the depreciation; prior law mandated the subtraction of salvage value when the straight-line method was used.

Newly acquired property affected

The changes in the law affect only property that is placed in service by the taxpayer on or after January 1, 1981, although it is irrelevant whether the property is new or used when the taxpayer acquires it. Property placed in use before 1981 will continue to be depreciated under methods approved by prior law, and there is no direct way to bring it within the coverage of the new act. Of course, the advantages of the recent changes might be so attractive that a taxpayer would decide to sell his existing buildings and purchase others to which the new benefits would then apply.

The accompanying listing is for a Basic program designed to compute cost recovery for real estate under the new act. It is written in level II TRS-80 Basic, but contains few features that could not readily be translated to other dialects.

As mentioned above, the A.C.R.S. method for real estate allows deductions that are essentially the same as 175% declining balance (200% for low-income housing), shifting to straight-line when it is advantageous to do so. The new act does not impose on the taxpayer the task of computing the deduction amounts directly from the declining balance formula discussed above. Instead, it directs the I.R.S. to issue a pair of tables that roughly incorporate these two declining balance methods and give the taxpayer a percentage factor to be applied each year to his original basis. The service has published these tables, and they are in effect incorporated in the DATA statements in lines 1000 through 1360 of the program.

The tables differ from a straightforward declining balance computation in two technical ways. First, the factors they give are rounded to the nearest full percent. Second, they assume (based on language in the new act itself), that during the first year of the schedule, a proration on only a monthly (rather than a daily) basis is appropriate. For example, a taxpayer who places a building (other than low-income housing) in service on March 20 is treated as having "credit" for the entire month of March; his cost recovery factor for the tax year (if he is on a calendar year basis) is 10%. Property placed in service any time during January

would be entitled to a full year's "credit," or 12%. These factors may be seen in the DATA statement in line 1210. There is no similar set of official tables for the 15-year, 35-year or 45-year straight-line methods, but the act seems to contemplate the same month-by-month approach, with partial months treated like full months; the program takes this approach.

When the program is run, a menu is displayed. The user may either view the A.C.R.S. tables on the screen or instead go directly to the computation of a cost recovery schedule. Displaying the tables has no great utility for most taxpayers, and the portions of the program that do it may be deleted if desired; they are lines 330-340 and 610-860.

Whether or not one wishes to display the tables, they must be placed in memory in useable form. Lines 510 through 590 READ the DATA lines and place the tables' percentage factors in two arrays, P (for low-income housing) and Q (for other real estate). The arrays are two-dimensional, with the first dimension being the month (1 to 12) and the second dimension the year (1 to 16). Sixteen years must be included on the tables, because if property is placed in service in a later month than January (for a calendar-basis taxpayer), the 15-year recovery schedule will not end until some time in the 16th calendar year. Note that lines 510 through 590 are essential to the program, even if the table-display feature is eliminated.

Lines 2000 through 2130 provide an input routine for collection of the raw data necessary to compute a cost recovery schedule. The user must input the original basis, month and year the property is placed in service, and the recovery method to be used. Lines 2030, 2040 and 2050 contain an interesting feature; they display the previous values of these data before asking for input of them. When an INPUT statement appears in TRS-80 Basic and the variable has previously been assigned a value, that value is simply retained for the variable if the user presses ENTER in reply to the INPUT prompt. This is very useful if the program involves cycling through the INPUT section several times in succession. If the previous value is displayed and is satisfactory to the user, he can merely press ENTER rather than retype the same value; only changed values need to be typed. If you adapt the program to a Basic dialect in which this technique will not work, simply replace lines 2030-2050 with ordinary INPUT statements.

The program uses an error-avoidance method when eliciting a menu selection from the user. The INKEY$ routine is employed to permit the computer to accept a choice of items without the need to press ENTER. An IF...THEN...ELSE statement is next used to keep the computer in the keyboard-scanning INKEY$ mode if an inappropriate key is pressed. See lines 410, 2070, and 2110 for examples. In effect, these lines tell the computer to ignore illegal responses.

Once the necessary data have been entered, the program uses either lines 4000-4060 or 5000-5140 to produce a heading for the schedule, depending on whether screen display or printer output has been selected. The same lines could have been used to provide both screen and printer headings, either by use of a subroutine to change PRINTs to LPRINTs and back again or by swapping the addresses in the screen and printer Device Control Blocks. But using separate lines of code for screen and printer display has the advantage of permitting flexibility in formatting the two, and the additional memory required is minimal.

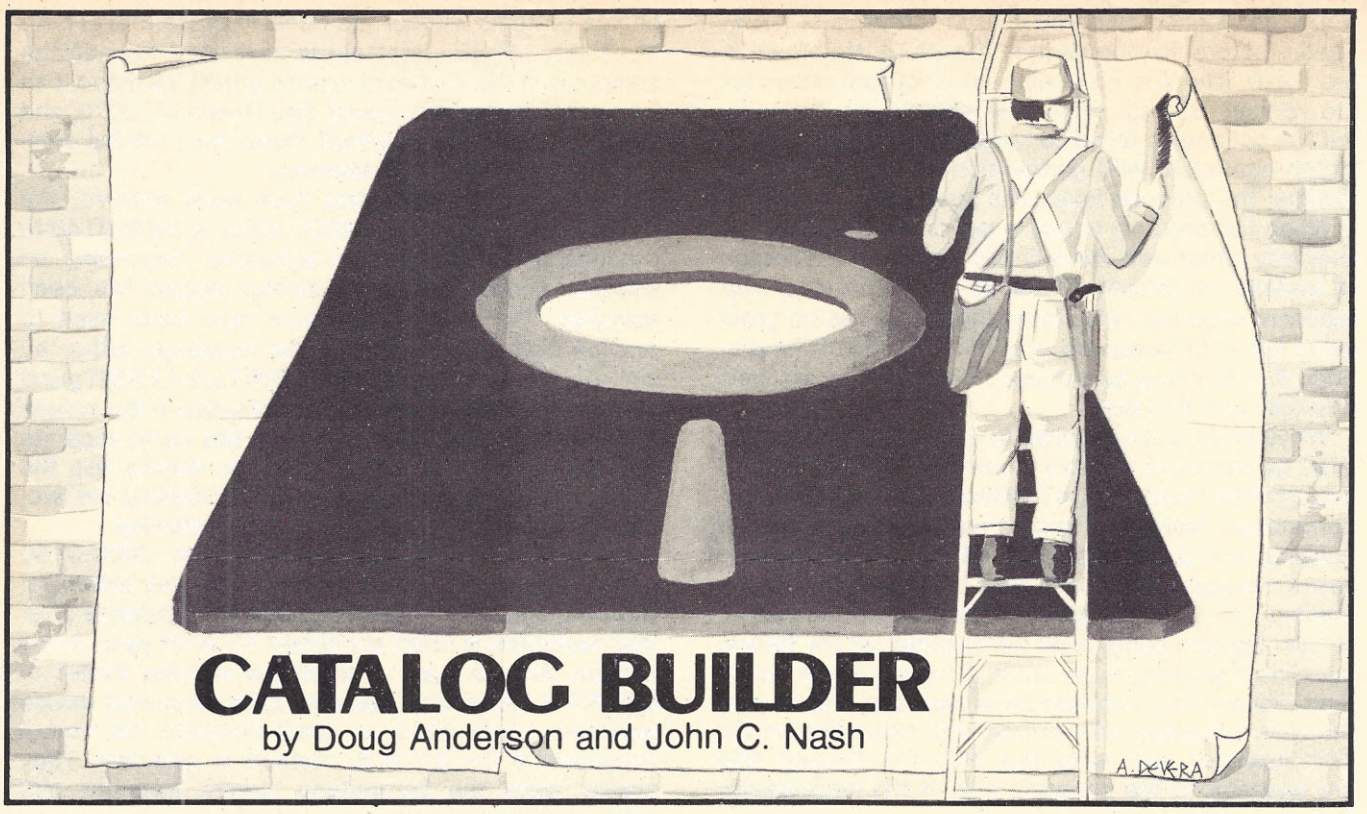
Finally (and most importantly), lines 3000-3180 calculate and print the actual cost recovery schedule. Both the annual deduction and the basis balance after that deduction is taken are shown for each year. A flag variable (B%) is used to determine whether PRINT or LPRINT is appropriate, depending on the output device selected. Lines 3080 or 3090 compute the annual deduction if the A.C.R.S. method is selected. They merely apply the percentage factors from the IRS tables to the original basis.

If the straight-line method is used instead, line 3060 calculates the deduction for all years except the first or last. Line 3070 performs the straight-line first year calculation, prorating the deduction on the basis of the number of full or partial months the property is in service during the first year. For the final year (actually the 16th year if a 15-year schedule is used, for example), line 3050 simply takes the entire remaining basis as the deduction, even if this is less than a full "standard" year's because a partial year's deduction was taken in the first year.

The calculation section is not particularly fast, since double-precision variables are used. For many practical purposes, single precision would be accurate enough, but it is irritating to have digits beyond the 6th rounded off, especially when million-dollar-plus properties are involved. Double precision does the job much more neatly and lets the user forget about accuracy problems.

See related article on page 66. □

Program on page 154



CATALOG BUILDER

by Doug Anderson and John C. Nash

The North Star DOS and Basic allow the user to display or print the catalog of files on an individual diskette. However, the information in the catalog is not available to programs, for example, to build a sorted list of all files on a set of diskettes. The accompanying program performs this task, and its subroutines can be used for other applications.

The North Star DOS stores catalog information in the first four sectors on the disk (sectors 0-3), a total of 1K bytes (single density) or 2K bytes (double density) of data. Each file is described by 16 bytes of information:

Bytes	Contents
0-7	File name
8-9	Disk address (sector number of start)
10-11	Number of sectors in file
12	File type (if >128, file is double density)
13-15	Type dependent information

The rest of the discussion concerns the single density DOS, but a similar technique can be used for double density.

The DOS subroutine to read disk information, DCOM, is invoked in Release 4 of the North Star DOS by a call to memory location 2022H (7680D), where there is a jump instruction to the routine itself. DCOM requires that:

Register A contain the number of sectors to be transferred to or from disk;

Register B contain a 1 to read the disk, a 0 to write it, or a 2 to verify the contents against memory;

Register C contain the disk drive number to be used;

Register pair DE contain the starting memory (RAM) location from/to which information is to be transferred;

Register pair HL contain the starting disk address (sector number) from/to which information is to be transferred.

Users of double or quad density systems cannot use this information as given, but must make minor modifications to accommodate the double density controller and software.

In order to access the catalog information on diskette from a Basic program, a machine language subroutine must be executed to load the registers with appropriate information and issue to call to DCOM. The catalog sectors will then be transferred to the given area of RAM, from which information can be extracted by a series of EXAM (i.e. PEEK) instructions in Basic.

Machine language program code is usually produced by an assembler. Since the sequence of operations required is so short, however, it can be stored in DATA statements in Basic and transferred to an unused area of RAM at RUN time by a series of FILL (i.e. POKE) commands. This is what happens in the subroutine at line 0340 in the program below. Note that a one line DATA statement will suffice; here the DATA has been commented to allow users to change the code as appropriate.

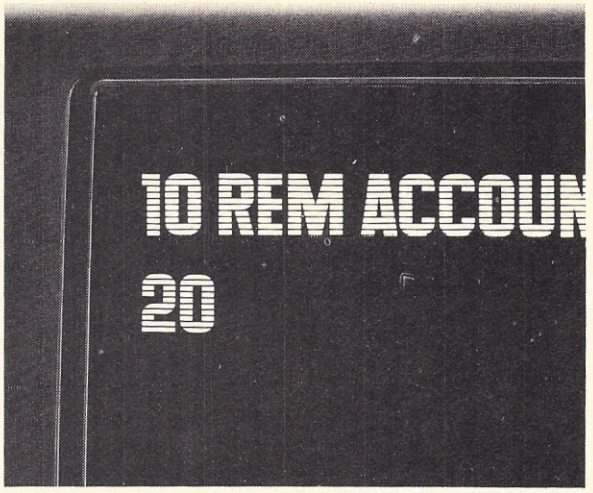
It is possible to give the catalog itself a file name, which serves also to name the diskette. This file is located at disk address zero. Our program assumes that the first filename encountered with disk address zero is this name and that any others are comments and can be ignored. If no such filename exists, the disk is "un-named" and the catalog operation for such a disk is skipped with an appropriate warning given.

The program becomes quite slow for large numbers of files because of the sort technique used, so that a catalog of a substantial number of disks (30-40) is better accomplished by a different sort mechanism. For a few disks (10-20), the insertion sort used in the program is both simple and effective.

Note that the program can be used to provide sorted catalogs of individual diskettes. With relatively minor modifications, it could also be used to present the catalog of a given diskette in disk address order. □

Program on page 156

BOY, IS THIS COSTING YOU.



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Software Review:

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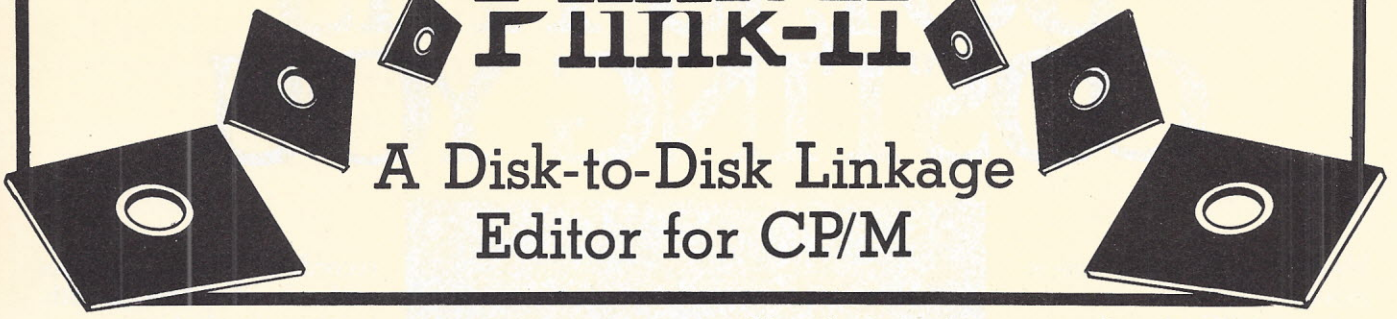

A Disk-to-Disk Linkage Editor for CP/M

by Alan R. Miller

Digital computers operate with binary circuits that can be represented by strings of zeros and ones. A program that is executed by such a computer must ultimately be in this binary form. But this representation is difficult to write or comprehend. Consequently, computer languages such as Fortran, Pascal, and Basic have been invented to make the programming task easier. The user writes a *source program* utilizing the letters of the alphabet and the ten digits. Then a translator program, called either a compiler, interpreter, or assembler converts the source program into instructions that the computer can understand.

Basic is usually implemented as an interpreter. The converter program interprets each line of the source program as it is encountered. Most Fortrans, some Pascals, and Microsoft's Bascom Basic are implemented as compilers. The compiler converts the source program into an intermediate relocatable (REL) file. At the conclusion of the compiling step, a linking-loader program generates the required binary code. CBasic and some Pascals convert the source program into an intermediate file that is interpreted. Finally, if the source program is written in assembly language, an assembler is used to generate the binary code. This conversion is sometimes performed in a single step. At other times, however, an intermediate relocatable file is generated. The two-step approach makes it possible to combine assembly language programs with Fortran, Pascal or Basic routines.

As programs grow larger and larger, the compiling time increases. Any change in the source code means that the entire program has to be recompiled. An alternative to this approach is to divide a large program into small modules. Each module is separately compiled. Then a complete executable program is constructed from the modules by using a linking loader. If one module has to be changed, only that module must be recompiled. Of course, the complete package must be linked again into a new binary executable program.

A trivial but instructive example of the modular approach is shown in the accompanying listing. The main program is written in 8080 assembly language, but the technique applies to a compiling language such as Fortran. The main program is designed to print an initial message and then call subroutines SUB1 and SUB2. Notice that the label START is given as an argument to the END statement of the main program and that names of the two subroutines are declared in an EXTRN statement near the beginning.

When the first subroutine is called, it prints an identifying message, then returns to the main program. A second subroutine, SUB2, is then called. It, too, prints an identifying message and returns to the main program. Finally the main program prints a terminating message. Notice that ENTRY statements are used at the beginning of each subroutine. The two subroutines could, of course, be coded as part of the main program. In this case, all of the instructions would be part of the same disk file. However, in this example, three separate files are utilized. The main program is identified with the filename MULT.MAC and the two separate subroutines are given filenames SUB1.MAC and SUB2.MAC, respectively.

All three of these files can be compiled with the Microsoft macro assembler, then linked into a binary file with the linking loader. The Microsoft loader uses the relocatable disk files to generate the desired binary code in memory. The resulting program can be either executed directly or saved on disk as a COM file for execution at a later time.

Two problems can occur when the resulting binary program is very large. The loader itself requires some memory space for its operation. Consequently, a program that just fills the regularly available memory cannot be linked in this way. Another problem occurs when the program is too large for the available memory.

Sometimes it is possible to execute very large programs in a sequential manner. For example, when analyzing a very large set of data, it may be desirable to obtain a plot. If the plotter is only needed at one point in the operation, it is possible to overlay the plotter routines after the plot has been obtained. In this way, certain memory regions can be overlaid again and again during the course of the calculations. In this case, memory space is traded for the increased execution time needed to load the overlay files.

Phoenix Software Associates, Ltd. (North Easton, MA) offers Plink-II, a disk-to-disk linking loader. It can link relocatable programs generated with Microsoft's Fortran, Cobol, Pascal, assembler and Bascom into an executable file. According to the 50-page user's manual, it can also link programs compiled with Pascal MT+, Pascal/Z, PL/I-80 and Whitesmith C.

Programs linked with Plink are a little smaller than those produced by Microsoft's loader. However, Plink runs much slower, since the output is written to a disk file. If a Basic program called LEDGER.BAS is compiled with Bascom, Plink can be used to generate an executable file. The command is simply:

PLINK-II FILE LEDGER

Plink is especially suitable for large programs. Since the resulting binary code is placed into a disk file rather than memory, it is possible to produce programs that will complete the memory space. In addition, programs much larger than the available memory space can be run by using a series of overlays. An overlay loader is included with Plink.

The Plink commands are a little different from Microsoft's. Command input is freeform; statements and arguments are separated by blanks. If the command line is short, it can be included on the initial line. For example, the three modules shown in the listing can be linked into an executable file called MULT.COM by giving the command:

```
PLINK-II FILE MULT, SUB1, SUB2
```

The FILE statement in this command designates three input files. The output filename is also indicated implicitly as the first input filename. On the other hand, the OUTPUT statement can be used to give the output file a different name. For example, the command

```
PLINK-II OUTPUT MULT3 FILE MULT, SUB1, SUB2
```

sets the output filename to MULT3.COM.

A longer command line can be handled in one of two ways. The list of statements can be placed into a seperate disk file with a filename of MULT.LNK. Then the command

```
PLINK-II @MULT
```

directs Plink to obtain the commands from the referenced file as though they had been typed at the console.

Another method for dealing with a long command line is to simply type the command:

```
PLINK-II
```

without an argument. Plink responds with a star symbol on the next line. One or more statements can then be typed on this line. Type a carriage return at the end of the line and another star symbol will appear at the beginning of the next line. Additional statements can be typed on this line too. Continue in this way with as many lines as needed. After the last statement has been given, type a semicolon, then a carriage return; Plink will begin executing the statements. At the conclusion of the command, Plink can be given a new task to perform or it can be terminated with a Control-C or the letter Q followed by a semicolon.

For assembly language programs, Plink adds seven bytes of code starting at 100 hex. Four bytes are used to set up the stack pointer and three more are used to branch to the actual start of the program. If you want your program to begin at 100 hex, include a LOCATE 100H statement in the command string. This will eliminate the extra seven bytes. For example, the command

```
PLINK-II LOCATE 100H FILE MULT, SUB1, SUB2
```

will create an output file MULT.COM with the actual code beginning at 100 hex.

Suppose that the two subroutines shown in the listing were both very large. Since the main program calls each one in turn, it is not necessary to have them both in memory at the same time. Using Plink, it is possible to begin execution with only the main program and the first subroutine in memory. After the program returns

from the first subroutine, the second subroutine can be laid over the first. Plink can perform this task by creating overlay modules. The statements might be:

```
PLINK-II
*OUTPUT MULTOV.PRG
*FILE MULT
*BEGIN
*   OVERLAY FILE SUB1
*   OVERLAY FILE SUB2
*END;
```

The first line executes Plink. The second designates the name of the output file. The third designates the name of the first input file. The BEGIN/END block gives the names of files that are to share the same memory space. In this case, SUB2 is to be laid over SUB1. Notice that the output file is not a COM file, so it cannot be directly executed. A utility program is executed instead. To run the above program, give the command

EXECUTE MULTOV

Try this technique with the accompanying program and you will obtain the same results as before.

There are many additional features to Plink. For example, a simple or detailed linkage-editor map can be produced. The output can be sent to the printer or to a disk file. LIBRARY and SEARCH commands can be used to search a library of routines. However, these commands are not needed when linking Microsoft programs.

Plink-II is a valuable addition to the pool of quality CP/M software. Those who compile or assemble large programs will definitely want to consider it. □

Program listing.
A Modular 8080 Assembly Language Program

```
; Main program
;
BDOS    EQU     5
PBUF    EQU     9
CR      EQU     0DH
LF      EQU     0AH
;
ENTRY   START
EXTRN   SUB1,SUB2
;
START:
        LXI     D,MESG
        MVI     C,PBUF
        CALL    BDOS
        CALL    SUB1
        CALL    SUB2
        LXI     D,MES2
        MVI     C,PBUF
        CALL    BDOS
        JMP     0
;
MESG:   DB      CR,LF,"Main program $"
MES2:   DB      CR,LF
        DB      "Back in main program $"
;
        END     START

; module SUB1, first subroutine
;
BDOS    EQU     5
TYPEF   EQU     2
PBUF    EQU     9
CR      EQU     0DH
LF      EQU     0AH
;
ENTRY   SUB1
;
SUB1:
        LXI     D,MES1
        MVI     C,PBUF
        CALL    BDOS
        RET
;
MES1:   DB      CR,LF,"In SUB1 $"
        END

; module SUB2, second subroutine
;
BDOS    EQU     5
PBUF    EQU     9
CR      EQU     0DH
LF      EQU     0AH
;
ENTRY   SUB2
;
SUB2:
        LXI     D,MES1
        MVI     C,PBUF
        CALL    BDOS
        RET
;
MES1:   DB      CR,LF,"In SUB2 $"
        END
```

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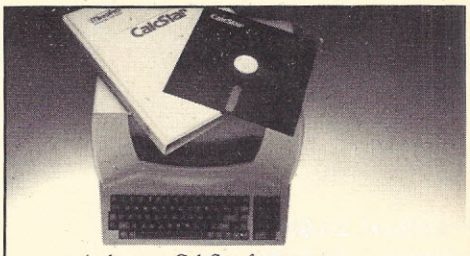

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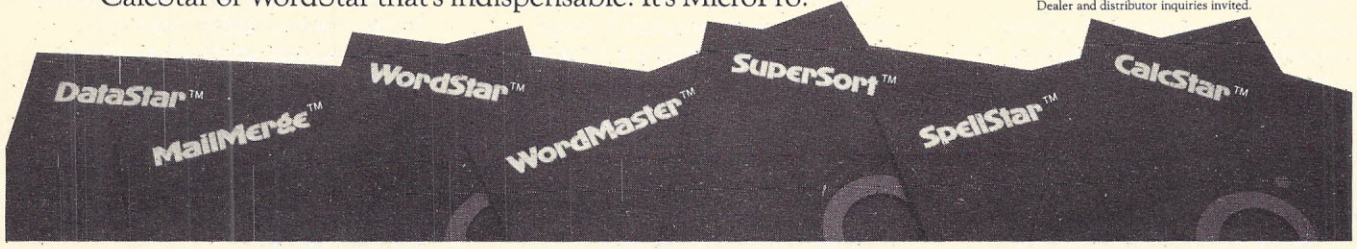

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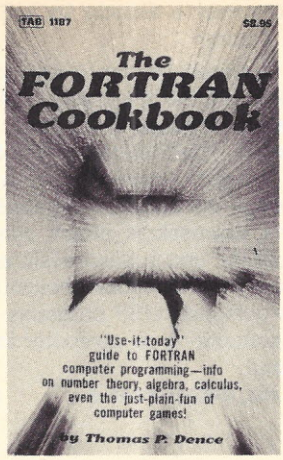

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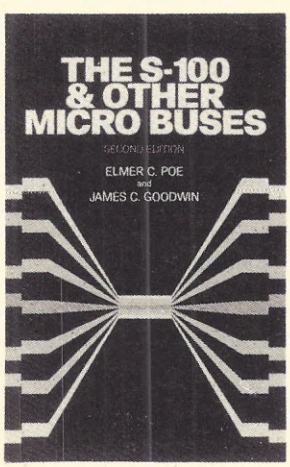

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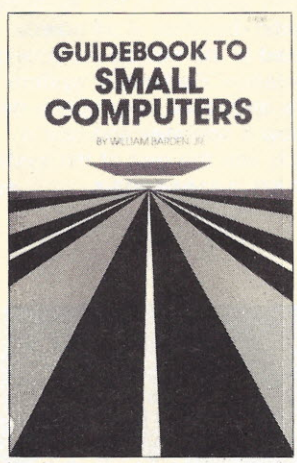

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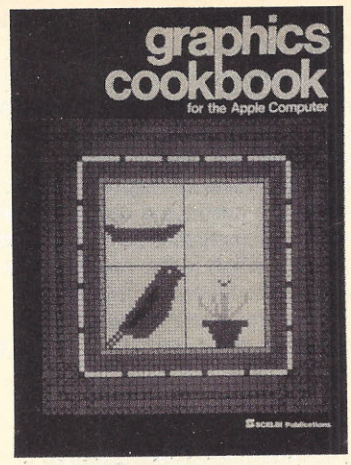

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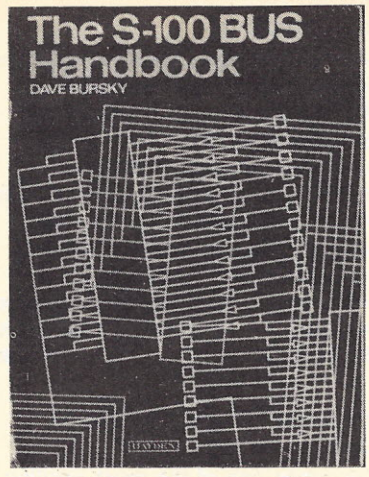

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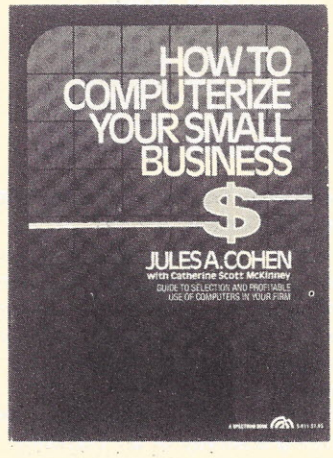

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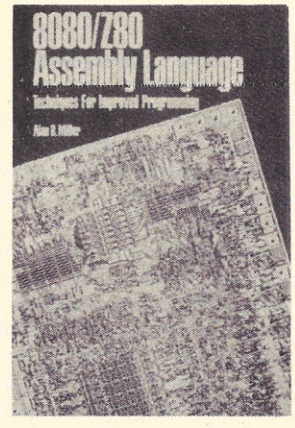

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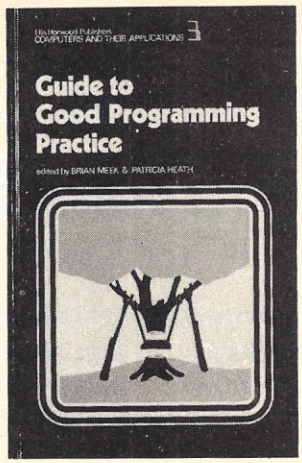

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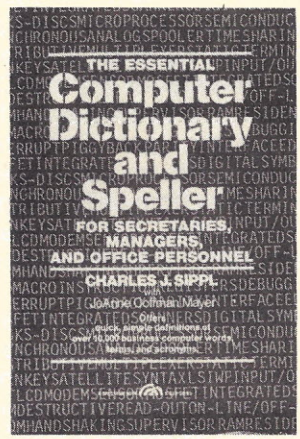

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UPDATE: COMPUTERS BY MAIL

by Tom Fox

Mail order computer outlets—good or bad? Welcome relief for the budget-conscious computer purchaser, or a threat to the health of a budding industry?

A year ago, *Interface Age* suggested that, for the expert buyer, mail-order sources were worthy of consideration. Proprietors of many Computerland franchises disagreed, and flooded our office with protest letters. More recently, Apple Computer made a direct attack on the problem: an edict was issued prohibiting any Apple dealers from selling Apples by mail.

In both cases, we see major corporations in the microcomputer industry stepping outside their normal roles of providing "what the customer wants." Not only are they deciding the kind of product we are privileged to purchase, but they are using their considerable weight in an attempt to influence the manner in which computers are sold to the public. It's for our own good, we are told. Computers are just too complex, the buyers simply too ignorant, to get good utility out of these useful machines if they are left to their own devices to puzzle out their mysteries. Are they right? In this article, we will explore the alternatives from the purchaser's standpoint. What's best for *you*?

It's been a good year for purveyors of microcomputers. This can be seen in the progressive repopulation of computer stores on the streets and in the shopping malls of our country. There was a period of thinning out that worried some, but the creeping legitimization of the micro idea by IBM and other respected institutions has refueled the whole industry. Computer stores are more common than ever before—and most welcome, in our view.

Significantly, the proprietors are seeming to pay more attention to the training of their sales staff. This effort takes two forms, depending upon the background of the individual involved. A glimmering of technical knowledge is being painfully force-fed into the craniums of professional sales people, and technically-oriented persons are being introduced to the arcane skills of communicating with living, breathing customers whose internal thought processes are not based upon the binary number system.

The training process is far from complete. We are a long way from a world in which the typical computer seller knows enough about his product. But give this fledgling industry time. It is, after all, faced with the task of educating a whole generation of skilled merchandisers in a marketplace absolutely exploding with strange, difficult-to-comprehend products.

There's a place in Mission Viejo, CA called the *Computer Mall*. It's a modest collection of four computer-related stores: One sells big computers; another, little micros. The other two are strictly in the accessories business. One sells pre-programmed ("canned") software; the other, furniture and consumable supplies. All four stores are operated under the same management—people with vision who believe that computer stores are destined for the same fragmentation that struck the automobile industry early in this century.

At one time, you bought an automobile at an automobile store. When it needed oil or tires or even gasoline, you went back to the same store. The reason was simple: they were the only ones in town who had the special knowledge to keep your horseless carriage running. Now, of course, most of us feel we know our cars well enough to pick the right octane at the gas station, and even buy an occasional seat cover through a mail order catalog.

Many predict that the computer industry will face the same transformation. For now, however, most computers are sold by the modern-day analog of the pioneer general store. If it has to do with computers, it's all in that one cluttered room. Today's computer stores serve a need—a very critical need—in a way that no other outlet can match. A good computer store will beguile you, entertain you and educate you. It will help you decide if the very thought of purchasing a computer fits your business or life style. It will narrow the choices for you, and happily take your money when you settle on the right machine.

A good computer store will teach you how to operate your new purchase, and how to use it best. In some cases, you depend upon the computer store to tell you how to adjust your business practices in order to get the most out of your system. A computer store will sell you software programs, often even adapting them or inventing them especially to your specifications. A computer store will fix your equipment when it stumbles and keep it supplied with paper and printwheels. It will offer you all sorts of enhancements, expansions and updated releases as the manufacturers churn them out. Finally, a good computer store will feature a library of reference books and the place to buy the latest computer-related periodicals.

It's a lot to ask of one enterprise; few industries can claim equally self-sufficient retail centers. Some of the niceties are expensive to maintain. First among these is the initial and continuing education of you, the customer. The do-everything environment described above is supported mainly from profits earned on equipment sales. And the profit margins on computers (typically 25% to 40%) are not exorbitant by any standards. Bedroom furniture and refrigerators are commonly sold at higher markups.

As the population's general level of computer knowledge increases (largely due to the successful efforts of the computer stores themselves), more and more people are looking around for alternate places to spend their money. Mail order suppliers are rushing to fill this

need. If the proliferation of computer stores is remarkable, the explosion of new mail order enterprises is nothing short of astounding. Some (but certainly not all) are quite successful, so they must be serving a real need. What can a mail order warehouse do that a computer store can't do better?

They can sell merchandise for lower prices, for one thing. With no salesman to train, no dressed-up showroom full of expensive demonstrators to maintain, and limited commitment to after-sales hand-holding, the costs of running a computers-by-mail operation are significantly less than those faced by a typical computer store. Mail order houses can afford to offer reduced pricing, and the natural forces of competition have forced them to do just that.

A new computer purchaser is presented with an almost irresistible offer: that of saving hundreds or even thousands of dollars by simply buying from a far-off mail order warehouse. Why would one want to pass up such a deal?

Many will say that the offer is no bargain at all, when you take into consideration the time you will waste learning on your own what a computer store could demonstrate in a few minutes. They point out that the mail order purchaser takes upon himself the responsibility of selecting the right combination of compatible hardware and software and making it operate harmoniously together. He or she is faced with fighting over possible warranty problems via long distance. And, perhaps, risk being stuck with a broken machine with no local service center.

If this scenario doesn't bother you; if you are more capable and self-sufficient than most—then it's hard to think of a reason why you shouldn't look for a computer at the cheapest available place. But if you should get stuck somewhere between opening the carton and making the thing run, be prepared for a humble, hat-in-hand visit to your local computer emporium for some on-the-spot assistance. If you are able to persuade the personnel to help in this situation, be prepared to pay a fair price for the specialized knowledge imparted—$50 per hour and up is not uncommon.

Discount stores are appearing

In large cities, a middle choice is evolving. If you are put off by the pricing of the full-service computer store and feel nervous about mailing large checks cross-country, you may have in your area a "discount" computer store. These establishments deal largely in pocket calculators, games and telephone answering machines. In addition, some are beginning to carry personal-sized computers and peripherals. Pricing in these places lies somewhere between full list and that seen in the discount catalogs.

But don't be fooled into thinking that a discount computer store will be able to give you the same services as a traditional, retail-only one. It's a matter of economics: they simply can't afford to do so. The services may be available, but they're usually at extra cost. System setup, training and documentation, if available, are often priced separately. In many ways, you're on your own just as much as if the postman had delivered your computer.

Once you make the initial purchase, you will find any number of places looking for your "consumables" business. As the number of microcomputers grows, there emerges the need (and opportunity) to supply collateral materials and services. Just as the richest men in last century's gold rush towns tended to be saloon keepers and laundry operators, fortunes are being made today in the sales of floppy disks, computer paper—and, of course, software programs. An officer of Computerland once told us that the sales of such products accounted for nearly 50% of an average store's gross revenue. Perhaps that says something about how much you should budget for the upkeep of your micro after you have made the initial purchase.

Consumables such as disk packs, mailing labels and binders for printouts require only a small amount of special skill on the part of the retail store. Once the mysteries of single/double density and single/double sided floppies and their various formats are puzzled out, it's easy to stock and sell this kind of merchandise. Increasingly, we are seeing local stationery and office supply stores offering these products. It's the sign of a maturing industry when the computer purchaser is given a choice of sources for the reams of paper and miles of black ribbon that the office micro chews through as it does its work.

Some of the mail order catalogs listed in the accompanying chart offer nothing but consumables. They specialize in these products, and offer a wider range of choices than what is normally found in a computer store or stationery outlet. Some of the catalogs are almost exclusively populated with canned software programs —everything from games to educational programs to business packages. Word processors and VisiCalc-like spread-sheet planners abound. There is a particular skill necessary when purchasing software: you need to make sure the program works, and you need to make sure it works on your machine—your particular combination of processor, operating system, language, terminal and printer. Software is difficult to evaluate under the best of circumstances; there's a real element of chance-taking when buying it sight unseen. And because it's so easy to make duplicate copies of programs, most outlets have a strict *no return* policy on software.

Just as we did in our *Computers by Mail* article a year ago, we are including a chart of some of the mail-order sources for computers and computer-related products. Choosing entrants for this year's chart was a far more difficult chore, since the number of people in the business has risen dramatically. In an attempt to pare down the list, we selected only those companies that will agree to send you a catalog. (There are many more mail-order outlets who simply run advertisements in magazines or newspapers.)

The catalogs we've seen range from slick, savable volumes to bundles of stapled-together manufacturers' data sheets. Some are full of useful, helpful hints; others assume you know the exact stock number of the product you need. Some mail-order firms feature toll-free ordering numbers and a free, no-questions-asked return policy. Others have no phone numbers in evidence and lack a street address—just an anonymous post office box number. Although these clues may have nothing to do with the quality of the mail-order enterprise or the usefulness of the products you receive, we counsel care in selecting your sources. □

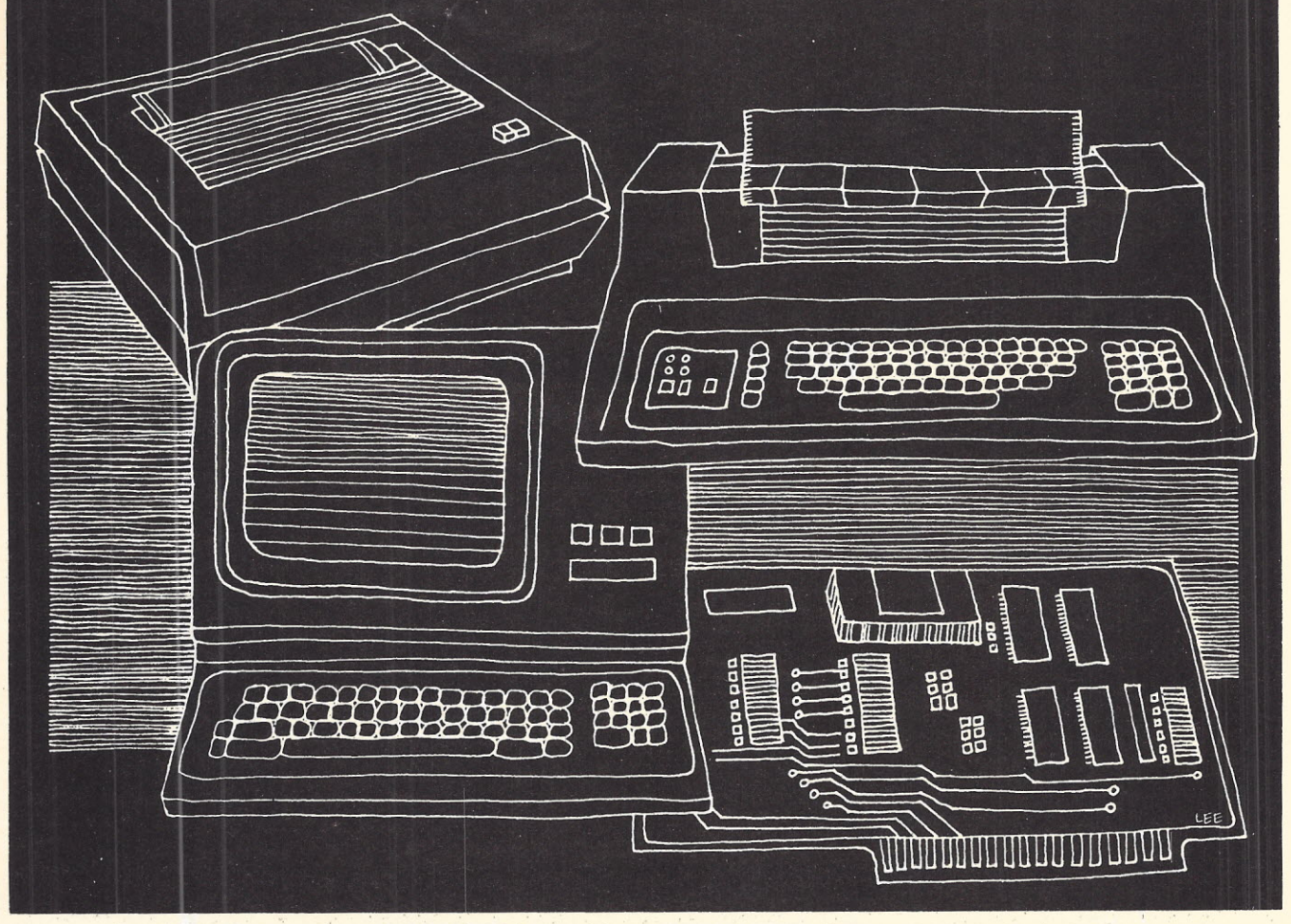
Chart follows

Computers by Mail: Some Suppliers

Company Name and Address	Pages	Contents
Advanced Computer Products P.O. Box 17329 Irvine, CA 92713	34	Floppy diskettes, filing devices, ribbons, printwheels, paper. Catalog also marked "Vista Information Products."
American National Supply P.O. Box 2259 Gardena, CA 90247	44	Modems, printers, tapes, disk packs, diskettes, ribbons, printwheels, paper, binders, furniture, cables
ASAP 1198 E. Willow St. Signal Hill, CA 90806	54	Electronic components, computers (Atari, Exidy, TI, QT), boards (S-100, Apple), floppy drives, printers, terminals, tools, diskettes
BETA Business Systems, Inc. 5555 Magnatron Blvd. #J San Diego, CA 92111	22	Floppy diskettes, ribbons, printwheels, accessories, tape cassettes, paper, labels
Challenge Computer Supplies 727 Middlefield Road Redwood City, CA 94064	26	Magnetic tape, disk packs, diskettes, filing devices, ribbons, printwheels, paper, furniture, cables, disk drive filters
CompuMart 65 Bent Street Cambridge, MA 02139	48	Computers (DEC, Apple, Rockwell, Commodore, Atari, H-P), disk drives, accessories, video monitors, printers, terminals, software, books
Computer Products International 424 Robbins Dr. Arcadia, CA 91006	8	Software, accessories
Computique 3411 S. Harbor Blvd. Santa Ana, CA 92704	66	Calculaotrs, watches, telephone accessories, games, computers (Apple, Atari, H-P, TI), printers, software
Concord Computer Products 1971 State College Anaheim, CA 92806	98	Electronic components, tools, accessories, boards (Apple, S-100), games, computers (TI, Apple, North Star, Atari) printers, books
Continental Resources, Inc. 175 Middlesex Turnpike Bedford, MA 01730	34	Cables, ribbons, printwheels, filing devices, diskettes, furniture, labels, data communications, terminals and printers (separate catalog)
David Jamison Carlyle Corp. 2049 Century Park East Los Angeles, CA 90067	2	Printers, terminals, data communications, computers (Data General, DEC, Apple, Atari, Panasonic, TeleVideo). Catalog is a large comparison chart.
Devoke Data Products 3780 Fabian Way Palo Alto, CA 94303	52	Furniture, accessories, filing devices, diskettes, cassettes, ribbons, printwheels, cables, safes, programmer's aids, binders
Fidelity Products 705 Pennsylvania Ave. S. Minneapolis, MN 55426	46	Diskettes, tapes, disk packs, paper, filing devices, labels, cables, ribbons, printwheels, accessories, binders, furniture
HW Electronics 19511 Business Center Drive Northridge, CA 91324	32	Boards (S-100, Apple, TRS-80), S-100 mainframes, modems, video monitors, printers, disk drives, diskettes, cables, software, components
Inmac 2465 Augustine Drive Santa Clara, CA 95051	98	Accessories, diskettes, filing devices, tapes, cassettes, disk packs, filters, paper, printwheels, ribbons, furniture, data communications, cables, tools

Company Name and Address	Pages	Contents
International Media Products 3017 Ocean Park Blvd. Santa Monica, CA 90405	16	Disk packs, diskettes, magnetic tape, paper, binders, ribbons, printwheels, accessories, filing devices
Jameco Electronics 1355 Shoreway Rd. Belmont, CA 94002	66	Electronic components, tools, breadboards, test instruments, video monitors, keyboards
Micromail P.O. Box 3297 Santa Ana, CA 92703	4	Printers, terminals, ribbons, printwheels
Misco 963 Holmdel Keyport Road Holmdel, NJ 07733	56	Diskettes, labels, filing devices, disk packs, cassettes, tapes, paper tape, accessories, furniture, cables, filters, ribbons, printwheels, paper, binders
Newman Computer Exchange 1250 N. Main Street Ann Arbor, MI 48107	26	Computers (DEC, Data General), printers, disk drives, terminals, cabinets, used equipment
Philadelphia Supply Corp. 16809 Pine Circle Fountain Valley, CA 92708	54	Floppy diskettes, ribbons, printwheels, disk packs, magnetic tapes, paper, labels, filing systems
E.D. Poe 941 Westwood Blvd. Los Angeles, CA 90024	103	Paper, labels, cassettes, diskettes, filing devices, printwheels, ribbons
Priority One Electronics 16723 Roscoe Blvd. Sepulveda, CA 91343	56	Boards (S-100, Apple, STD), diskette drives, video monitors, S-100 boxes, terminals, software, diskettes, books, components, tools
Protecto Enterprises 515 West Shadylane Barrington, IL 60010	6	Computers, (APF, TRS-80, Apple, Commodore, Atari), printers, accessories, software
Rainbow Computing 19517 Business Center Dr. Northridge, CA 91324	128	Software, Apple computers (see text), books, diskettes, boards (Apple), accessories
SJB Distributors, Inc. 10520 Plano Road #206 Dallas, TX 75238	22	Diskettes, filing devices, printwheels, tape, disk packs, furniture, paper, computers (Commodore), software, video monitors, accessories
Source System, Inc. 716 N. Wells St. Chicago, IL 60610	66	Furniture, filing devices, disk packs, tapes, diskettes, cassettes, ribbons, labels, binders, terminals, printers, safes, accessories
TSE - HARDSIDE 14 South St. Milford, NH 03055	24	Books, accessories, diskette drives, computers (TRS-80, Atari, Apple), printers, video monitors, software
Uarco 121 North Ninth Street DeKalb, IL 60115	64	Diskettes, filing devices, cassettes, disk packs, tapes, furniture, printers, printwheels, ribbons, paper, computers (Commodore)
Visible Computer Supply 3626 Stern Drive St. Charles, IL 60174	148	Binders, paper, accessories, furniture, filing devices, programmer aids, ribbons, printwheels, cassettes, diskettes, terminals, printers, cables, disk packs

NEW PRODUCTS DIRECTORY



HARDWARE

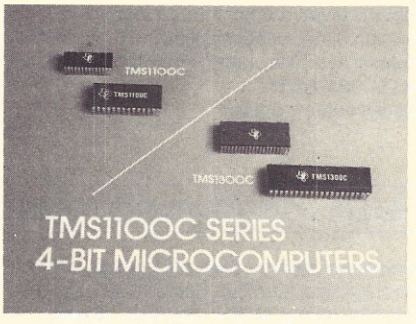
SOFTWARE

HARDWARE

COMPONENTS

8048 microcomputers, NS80C48 and NS80CX48 are ideally suited for use wherever high throughput, low power consumption, and reduced weight and size are required, such as in handheld electronic toys and instruments. The devices also maintain high performance in harsh environments common to telecommunications, automotive and geological instrumentation applications. The units are pin-compatible with the industry standard 8048s, and can directly replace standard 8048s in designs operating at speeds up to 6MHz (full speed for the standard 8048) without modification to either hardware or software. Both feature a fast 8-bit CPU, a 1K by 8 ROM for program storage, and a 64 by 8 RAM for data storage. Like all 8048-style microcomputers, the devices provide three 8 bit-wide bi-directional I/O ports and three additional I/O pins, for a total of 27 I/O lines. 96 instructions can be executed by the NS80C48, and with the Features Control Register, the NS80CX48 can execute 97. An on-chip 8-bit timer/counter is available to measure elapsed time or external stimuli, such as process control or frequency measurement. National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5000.
CIRCLE INQUIRY NO. 210

4-bit microcomputers, TMS1100C series, have a nominal operating voltage of 5 volts and a typical power dissipation of just 5 milliwatts. Other key features of the series include: 2K bytes of ROM, 512 bits of RAM, three levels of subroutines, and an on-chip oscillator that provides a clock frequency from 50 KHz to 1.2 MHz. The series also incorporates a power-saving HALT mode. In the HALT mode, the series' 5-milliwatt power dissipation is reduced to 5 microwatts. This capability, combined with the 5-volt operation, makes the series

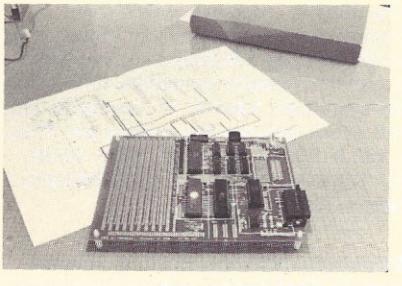


highly suited for use in battery-operated, portable applications. Two devices are currently included in the series—TMS1100C and TMS1300C. The two devices share many of the same features, but offer different I/O (input/output) capabilities. The TMS1100C is a 28-pin device with four data inputs and ten individually-addressed output latches. The TMS1300C, in contrast, is a 40-pin device with eight data inputs and sixteen individually-addressed output latches. Both have eight-bit-parallel latched data outputs. Prices: TMS1100C—$5.50; TMS1300C—$5.95. Texas Instruments Inc., Central Literature Response Center (SC-316) P.O. Box 202129, Dallas, TX 75220.
CIRCLE INQUIRY NO. 211

32-kilobit bipolar fuse-PROM has a read-access time of 40 nS, maximum and 30 nS, typical. Organized 4K by 8 bits, the 3632 allows OEMs of mainframe computers, minicomputers and CPU boards to begin new microcode-store designs with dense 32K parts, or upgrade existing hardware from 4K, 8K or 16K devices without sacrificing performance or paying a higher price-per-bit. It saves board space and reduces power consumption by 50% or more compared to designs using less dense parts. Two chip-select inputs to the 3632 permit easy expansion to larger PROM arrays. It is manufactured with polysilicon stacked fuse bipolar technology. The process yields excellent reliability and assures uniform programming current to the memory array through the device's polysilicon fuses. This device uses the same programming algorithm as models 3636 and 3636B. Needed to program it with a PROM programmer is a personality card, which contains programming circuitry and firmware dedicated to the part. Price: $55. Intel Corp., 3065 Bowers Ave., Santa Clara, CA 95051, (408) 987-7602.
CIRCLE INQUIRY NO. 212

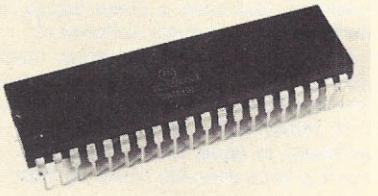
Joystick control, 271-1705, is actually a pair of 100K Ohm linear-taper potentiometers. This compact ($1\frac{7}{16}$in. square) part is intended for a variety of applications, including video games and computer peripherals; robotics; radio-controlled model cars, boats and planes; stereo and recording controls and more. It boasts a smooth action over a 30° displacement from center in all directions. The 1-in.-long control shaft has a removable (threaded) tip for easy attachment to plumb-weights in pendulum applications. And mounting screws are included. Electrically, each of the two 100K Ohm linear taper potentiometers outputs a resistance proportional to the part's positional displacement along each of two perpendicular axes; these analog signals can easily be digitized and used as inputs to a variety of equipment or devices. Price: $4.95. Tandy Corp./Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.
CIRCLE INQUIRY NO. 213

Printed circuit board, IDC-8, contains the circuitry needed to build a CPU



subsystem based on the 8-bit 8088 microprocessor. It features a custom serial interface area, and more than eighteen square in. of board space for wire-wrapping special designs and adding peripheral support circuitry and chips. It is well-suited for educational applications involving heavy course loads and experimentation and lab work. The 8088 is a 16-bit internal and 8-bit external microprocessor, fully compatible with Intel's 80/86 family of microprocessors and peripheral support chips. A separate accessory kit includes the sockets, resistors, capacitors, diodes, cables and standoffs necessary for assembly. Price: $87. Intelligent Devices Corp., 554 Washington St., Wellesley, MA 02181, (617) 237-7327.
CIRCLE INQUIRY NO. 214

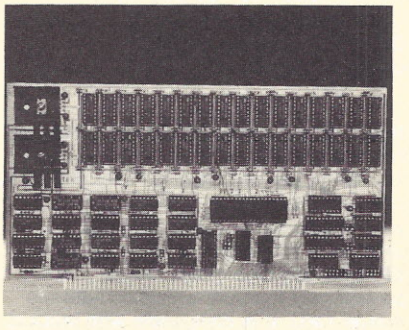
8-bit microcomputer, MC146805G2 CMOS MCU, combines the MC146805E2 with 2.2K bytes of ROM. The 40-pin device runs at dc to 1.0 MHz, using 3 to 6V supply. With a 5V supply, typical operation consumption is 15mV. In low-power modes, the device has a range of 0.1 to 3.0 mV. The system contains 112 bytes of RAM. It will branch on condition on any



RAM bit or any of thirty-two I/O pins. Four of the I/O pins drive 10 mA for LED displays, twelve drive 2 mA, and sixteen drive two low-power Schottky TTL loads. It is also self-testing, checking all addressing modes, most instructions, and the basic operation of RAM, ROM, ports, and timer. Price: $22.25. Motorola, Inc. MOS Integrated Circuit Div., 3501 Ed Bluestein Blvd., Austin, TX 78721.
CIRCLE INQUIRY NO. 215

CPU/MEMORY

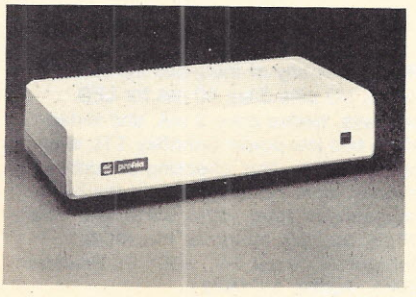
Memory board allows the use of three different memory board devices and is capable of providing from 16K to 256K bytes of bank selectable RAM on one IEEE S-100 board. The standard board uses the



16K dynamic RAM to provide reliable system memory. The board can be configured for four 16K byte banks that

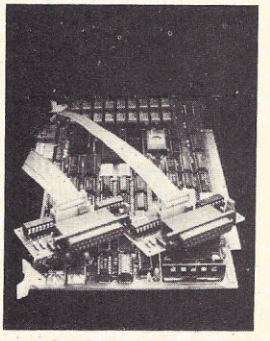
are addressable on any 16K boundary. In addition there is a 4K boundary deselect feature to allow custom partitioning of system RAM. The standard memory board can be upgraded at any time to use either the 5v only 16K devices or the high-density 64K devices. The 256K memory board provides four 64K byte banks with an optional 4K boundary select/deselect feature. This deselect option will enable the user to select one bank while deselecting the other three in hardware merely by addressing above a chosen 4K boundary. This circuit simplifies and speeds up operating system calls in multi-user systems. The return to the calling bank is made by readdressing below the chosen boundary. The board is fully IEEE-696 S-100 compatible and will interface to a wide variety of S-100 systems. Teletek, 9767F Business Park Dr., Sacramento, CA 95827, (916) 361-1777.
CIRCLE INQUIRY NO. 216

Mass-storage system, ProFile, increases by nearly 35 times the on-line storage capacity of Apple III computers. The system is a complete, self-contained unit featuring an intelligent controller, a 5¼-in. Winchester technology disk drive, a power supply, an interface card and driver software. It increases Apple III's on-line storge capacity to 5 million bytes, enabling users to safely store in one location information that would fill 35 floppy diskettes. It expands the usefulness of Apple IIIs in applications requiring large amounts of stored data. An



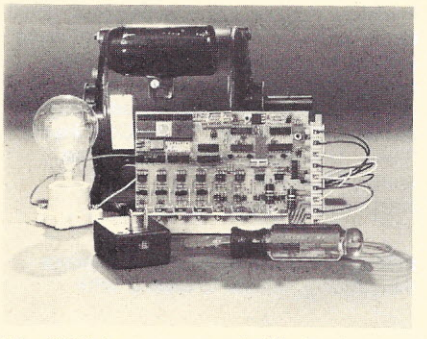
Apple-designed intelligent controller assures reliability and allows accessing of data nearly 10 times faster than with conventional floppy disk drives. Seven recently introduced software programs take advantage of the expanded capabilities of the enhancement. They include Apple III Pascal, Apple Business Basic, VisiCalc III, Apple Writer III, Access III, Script III and Business Graphics III. Prices: ProFile mass-storage system—$3,495; Apple III/ProFile system combined—$6,990. Apple Computer, 10260 Bandley Dr., Cupertino, CA 95014, (408) 996-1010.
CIRCLE INQUIRY NO. 217

Micro board, Net/82, provides complete networking capability for S-100 users, including bank switched memory and parity checking. It features a Z80A CPU, two serial ports, optional floating point processor, interrupt controller, shadow EPROM, real time clock, and an S-100 parallel port for communication with the master CPU. It is compatible with MuDOS, the high-speed operating system with advanced features offered by MuSys, as well as CP/M, MP/M and CP/NET. Parity checking permits easy detection of memory malfunctions. The 128K bank-switched memory option allows the program to select 48-36K of user RAM, controlled through an I/O port. Each serial port may also be customized for a variety of other applications, including interface with a serial printer. The interrupt controller provides standard interrupt configurations via jumper plugs. Wire wrap connections can be made to achieve special interrupt configurations. The real time clock provides a 60Hz interrupt source, derived from the baud rate clock. The board performs as a



slave processor in a network configuration. Each slave operates independently of any others, except for resource queuing in the master. Thus, the entire system appears to be dedicated to each user, unless a large amount of shared resources are being accessed. In addition, the board totally isolates the master CPU from errors in the slave processors. Price: $1,395; $1,995 with 128K and floating point processor. MuSys Corp., 1451 Irvine Blvd., Suite 11, Tustin, CA 92680, (714) 750-5693.
CIRCLE INQUIRY NO. 218

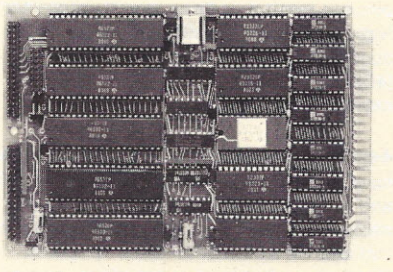
Single board computer is configured as a remote terminal unit (RTU) for distributed control and remote data acquisition applications. The 4½ in. by 6½ in. module includes a 6801 microprocessor, eight 12-bit analog inputs, 8-bit analog output, eight AC or DC inputs or outputs, serial I/O, watch dog timer, and power supply.



The 6801 is programmed with C-net, a communications protocol that allows up to 31 RTUs to be connected in a net with one or more master computers. C-net allows the systematic transfer of commands, data, and alarms between the masters and RTUs. Price: $199. Wintek Corp., 1801 South St., Lafayette, IN 47904, (317) 742-8428.
CIRCLE INQUIRY NO. 219

512K-byte memory board for Hewlett-Packard 9845-series desktop computers places over a megabyte of RAM within the reach of the individual user. To achieve this density - 4 times that of H-P's own boards for the 9845 - the program employs 64K RAM. The memory board adds two capabilities to the H-P desktop: a hardware security system, and the ability to add ROM modules with Basic extensions and utilities beyond those supplied by H-P. The memory board gives software suppliers and OEMs security against unauthorized software use. It has an electronically embedded code that can be read by the proprietary program. If the code is missing or incorrect, the user can be politely informed that he is not adhering to his license (or the program can be erased). In either case, it is impossible to run the program without the proper security code installed. This feature is in no way dependent upon the H-P SECURE feature, which prevents the program from being listed. Price: $6,500. Eventide Clockworks, 265 W. 54th St., New York, NY 10019, (212) 581-9290.
CIRCLE INQUIRY NO. 220

Single board micro, Cubit, is designed specifically for OEM control applications. The system features a compact modular design, Rockwell Aim-65 software compatibility and modest cost. The 6502-based CPU board measures 4.5 in. by 6.5 in., and includes 72 lines of I/O. Up to 4K bytes of RAM and 20K bytes of ROM may be installed on the board. Accessories include a 20-character display and thermal printer,



memory expansion boards and EPROM programmers. A panel-mountable instrumentation-style keyboard will be introduced in late August. Low-cost software development is aided by the Aim-65 software compatibility. Adding an EPROM programmer and cassette tape to an Aim-65 gives a complete development system. Price: under $1,000. Cubit, 240 Polaris Ave., Mountain View, CA 94043, (415) 962-8237.
CIRCLE INQUIRY NO. 221

DATA COMMUNICATIONS

Universal floppy disk controller, UFDC, incorporates a unique design that allows the intermixing of 5¼- and 8-in. drives, hard or soft sectored disks of different formats. The unit will allow a user to transfer data to and from different types of floppy disk computer systems. It has been designed to the S-100 bus IEEE standard. An 8080-Z80 system monitor is available with CP/M BIOS provided. A format utility program is provided that will allow the generation of any type of format. Compu-time, Box 5343, Huntington Beach, CA 92646, (714) 536-5000.
CIRCLE INQUIRY NO. 222

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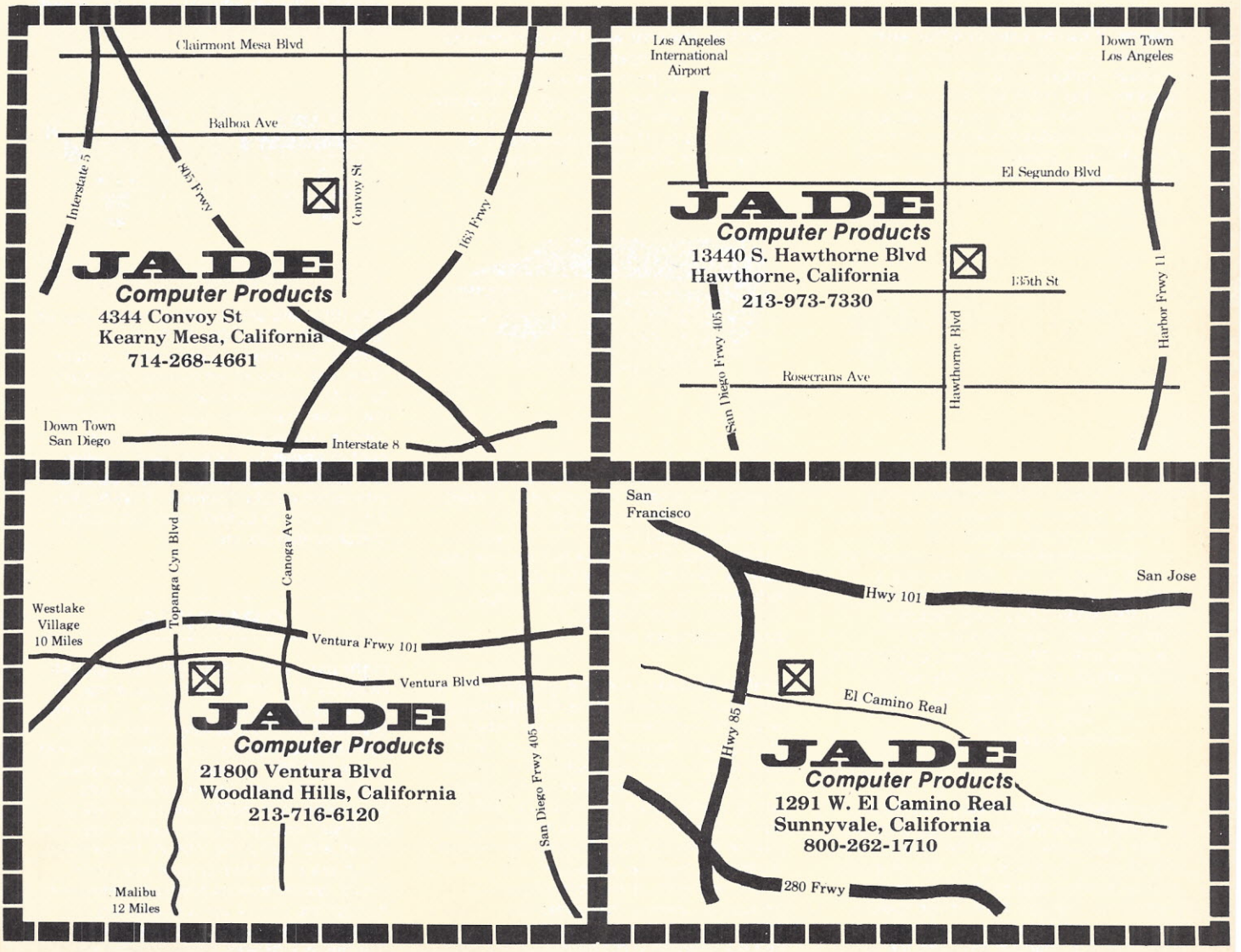
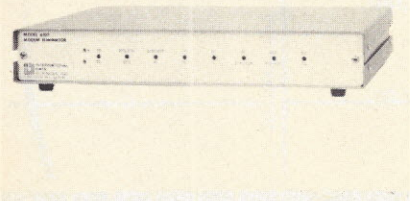


Microprocessor based networking systems support from one to 32 users, performing simultaneous tasks, in a fully CP/M compatible, multiprocessor environment. Eliminated are overhead and degradation problems associated with other network architectures, such as those based on a polling scheme. The interprocessor link enables application processors to talk directly to each other. It also gives users direct access to private or common files in the file processor. MegaBUS provides users with a direct link to shared peripherals, such as central printers. The minimum configuration consists of the File Processor (Z80A, 64K byte RAM with parity checking and floppy disk controller), 10M bytes Winchester disk storage, 8-in. floppy disk drive, two RS232C ports, one parallel port, and the n/STAR Network Operating System. This can be operated as a stand-alone single user system running under CP/M Version 2.2. For multiple users, the system runs under the n/STAR Network Operating System, with one application processor per user, up to eight users. Price of minimum configuration: $7995. Molecular Computer, 10311 S. DeAnza Blvd., Cupertino, CA 95014, (408) 446-9077.
CIRCLE INQUIRY NO. 223

Modem eliminator, Model 6100, is designed to allow for the interconnection of data terminal equipment without modems. It can be used in either asynchronous or synchronous modes, and with terminals configured for half or full-duplex operation. Use of the eliminator also provides a cost savings by eliminating two back-to-back modems operating within a short distance. Features provide internal strap selections for primary and secondary

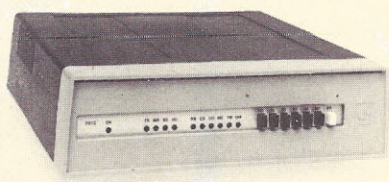


RTS/CTS delays, RC controlled by DCD, switched network or private line operation, ring memory functions and clock source. Data terminal equipment can be located up to 50 ft. from the unit, thus allowing a maximum separation of 100 ft. (500 ft. using IDS model 8520 Long Distance Interface Cable). Its DTE interface conforms to EIA RS-232-C and CCITT V.24 specifications. Price $710. International Data Sciences, 7 Wellington Rd., Lincoln, RI 02865, (401) 333-6200.
CIRCLE INQUIRY NO. 224

Time division multiplexer, GLM 504, provides for the transfer of large amounts of block data over a fixed link with fan-out at both ends. It permits up to four channels of synchronous data to share a common transmission facility. Thus, it can replace expensive multiple synchronous modem costs and line charges. Because the unit is compatible to any synchronous modem, it can fit into new or existing synchronous systems. Individual channel speeds are switch selectable fractions (1/8, ¼, ½, ¾ or 1) or the composite link rate. Standard features include: composite link operation to 56 Kbps, externally clocked; transfers interface control signals for all channels;

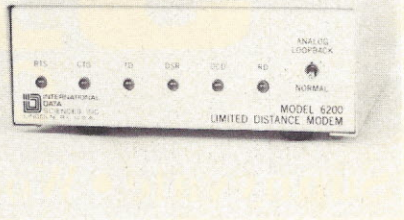
meets EIA RS232C and CCITT V.24/V.28 specifications; User selectable interface (DCE or DTE); 8-bit buffer; transparent to data (accepts any code); local loopback and remote test modes for system trouble-shooting; and point-to-point, pyramid network capability. Gandalf Data, 1019 South Noel, Wheeling, IL 60090, (312) 541-6060.
CIRCLE INQUIRY NO. 225

2400 BPS modem, DataComm 201C, combines low cost with high performance 2400/1200 bps operation over unconditioned voice grade lines and utilizes microprocessor and LSI design for reliability. Compatible with all Bell 201C/LIC, and CCITT V.26 bis (Type B) modems, it is designed for either switched network or



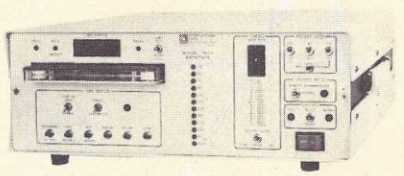
private line operations. In private line modes, this modem also operates in point-to-point or multipoint applications. In switched network modes, the unit will operate over terrestrial or half and full hop satellite circuits. General DataComm Industries, One Kennedy Ave., Danbury, CT 06810, (203) 797-0711.
CIRCLE INQUIRY NO. 226

Limited distance modem, model 6200 is designed for asynchronous operation over private 2- and 4-wire non-loaded metallic (twisted-pair) conductors at speeds up to 19,200 bps. It can be used in both point-to-point and multidrop network configurations and is ideally suited for local data distribution up to 9 miles. Features of the modem provide internal strap selections for receiver impedance, receiver equalizer, and 2- or 4-wire operation. It employs a baseband modulation scheme that varies the voltage of the transmit signal on a balanced line; therefore requiring DC continuity. Its data terminal equipment interface meets EIA RS-232 and CCITT V.24 specifications.



Price: $250. International Data Sciences, 7 Wellington Rd., Lincoln, RI 02865, (401) 333-6200.
CIRCLE INQUIRY NO. 227

Microprocessor-based recording device, Model 7000 Datatape, provides a non-volatile mass storage for digital data associated with the EIA RS-232-C and CCITT V.24 communications interfaces. It is designed for use as a portable, stand-alone unit, or to be used in conjunction with the IDS Hawk 4010 Datatrap. Data can be recorded and later replayed at any one of the sixteen rates to facilitate analysis of communications data link problems. The Datatape records transmit data (TD), receive



data (RD), and seven critical control signals (DTR, DSR, RTS, DCD, CTS, RI, and BUSY). Operation is independent of data code, line protocol, code level, and parity for both synchronous and asynchronous data links. Recorded data can consist of various combinations of TD, RD, and control signals to assist in fault isolation and conserve tape space. Price: $6,050. International Data Sciences, 7 Wellington Rd., Lincoln, RI 02865, (401) 333-6200.
CIRCLE INQUIRY NO. 228

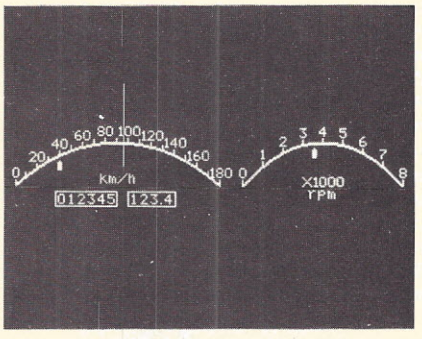
GRAPHICS

Light pen, LTP 105 A, features high-EMI immunity with high scan-rate response. A slim body dimension - 0.625 in. (1.59 cm) OD and 6 in. (15 cm) long - with tapered narrow head, permits easy aiming on target surface of CRT. A single 5-volt DC power supply is required. Maximum scan-rate responses up to 5000 cm/ms are typical. Light spot size and optical field of view are .01 in. and .080 in. to .160 in. respectively, which are controlled to meet customer needs. Mechanical switching is eliminated through the use of optical switching, producing no mechanical contact bounce. The pen is activated by depressing the

push-tip against the CRT screen. For graphics applications, additionally features an optical push switch on the barrel of the

pen, which can be activated up to 6 in. from the CRT. Prices: LTP 105A, $325; LTP 105 B, $349. Photobell Co., 26 Just Rd., Fairfield, NJ 07006, (201) 227-3613.
CIRCLE INQUIRY NO. 229

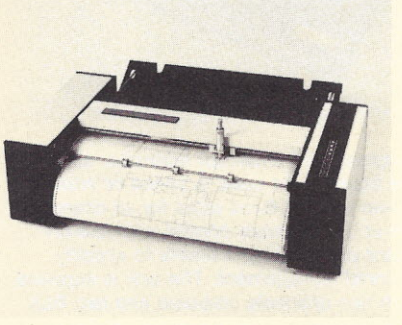
Fluorescent indicator panel, FIP 240A4XT, is used with word processors, point-of-sale terminals, automobiles, electronic typewriters, instrumentation or other hardware. It can display 240 characters in a format of 40 characters by six lines. It is 14 mm thick. The fine-pattern graphic unit can display illustrations, tables, drawings, and any combination of alpha-numerics. The 16,800 dot cells are arranged at uniform 0.65 mm pitch intervals in a display area measuring 38.80 mm (vertical) by 181.80 mm (horizontal). Each dot measures 0.45 by 0.45 mm. The unit



has a typical brightness level of 200 foot-lamberts and a high contrast level, particularly useful for use outdoors or in automobile dashboards. The color is blue-green filterable to red, orange, yellow, or other colors; nominal anode current per dot is 0.1 mAp-p; nominal current per grid is 6 mAp-p; typical anode voltage is 100 Vp-p; typical grid voltage is 50 Vp-p; duty cycle is 1/175; operating temperature range is between minus 10°C. and plus 60°C. Price: $200. NEC Electron Div., 252 Humboldt Ct., Sunnyvale, CA 94086, (408) 745-6520.
CIRCLE INQUIRY NO. 230

Electrostatic plotting package, Versaplot Random, produces graphic data in a new, more efficient format—Versatec Random Format (VRF). Rather than using traditional vectors, VRF enhances plotting efficiency by representing data in a more powerful "random element" form. A random element can be a DRAW command, a polygon and its number of sides, or a text string in multiples of 16 characters per string. Positioning commands represent MOVE and DRAW in compact notation. Non-positioning commands (TEXT, DEFINE PEN, etc.) consist of a command word and optional parameter words. The new format reduces the amount of data to be processed and the associated requirements for memory and data output. Run on the host computer, the Fortran-callable commands support plotting of virtually any graphic representation on most Versatec plotters or printer/plotters. Although using a different data format, the software is call-compatible with pen plotter programs and earlier plotting software. Extended graphic capabilities include grid overlay, area shading and toning. Prices start at $2,000. Bulletin #527, Versaplot Random, Versatec, 2805 Bowers Ave., Santa Clara, CA 95051, (408) 988-2800.
CIRCLE INQUIRY NO. 231

22 in. one pen plotter, the CPS-30, can be interfaced with almost any micro, mini, or maxi computer. It also allows the user to change or upgrade his computer system without having to replace the plotter. The unit also features a speed of 400 IPS, a step size of .005 in. touch-type switches,



fully dampened stepper motors designed to provide reliable and quiet 8-vector movement, and rugged construction for use in adverse conditions. Metric versions are also available. Price: $6400. Houston Instrument, One Houston Square, Austin, TX 78753, (512) 837-2820.
CIRCLE INQUIRY NO. 232

Graphics tablet, Demi-Pad 5, has industrial quality, 200 points/sec. digitizing, dual RS232 interface, 1 in. lock height (digitize up to one in. off the tablet surface), and the Z-80A microprocessor, which provides flexible output formatting. Price: $735. GTCO Corp., 1055 First St., Rockville, MD 20850, (301) 279-9550.
CIRCLE INQUIRY NO. 233

High-resolution graphics dump program, Grafpak, is for use with Apple II or Apple III in the Apple II emulator mode. It offers the widest range of scale factors available for dumping hi-res pictures. It is limited only by the constraints of printer dot density and carriage width. At least two scale factors are available for every printer, with some having as many as five different scale factors. It includes COMPOSER, a utility for positioning graphic images, cropping image edges, white/black inversion, and image framing. COMPOSER will also compress hi-res pictures to minimize disk usage, and expand them for conventional display. The program is compatible with Apple Computer, California Computer Systems, Epson, John Bell Engineering, Mountain Computer, SSM, Tymac Controls and other I/O cards. No expensive specialized cards or PROMs are needed. Price: $34.95. SmartWare, 2281 Cobble Stone Ct., Dayton, OH 45431, (513) 426-3579.
CIRCLE INQUIRY NO. 234

Decision support graphics software, DSG/3000, for Hewlett-Packard 3000 computers now supports the HP 2623A graphics terminal to enable users easily to produce line graphs, bar charts, pie charts and scattergrams. With the HP 2623A, HP 3000 users can integrate graphics into their business-reporting procedures. The program is menu-driven and interactive, enabling users to produce charts and graphs. A HELP facility also is available to provide on-line guidance. Users may enter data charts or graphs directly through a terminal keyboard, or from a data file, V/3000 forms-design package or user-written application programs. In addition, a built-in QUERY inquiry facility enables users to access IMAGE data bases to retrieve data for charts. A comprehensive set of high-level procedures that can be called from Cobol, Basic, Fortran or SPL programs also is available. Price: $6,300. Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, CA 94303.
CIRCLE INQUIRY NO. 235

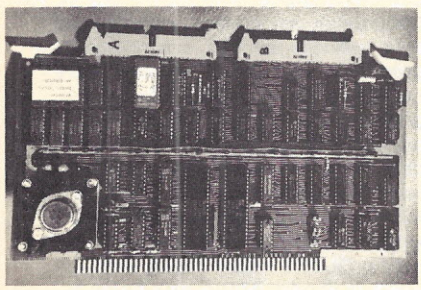
Graphic Writer for the Epson MX-80 (with Graf-Trax installed) and MX-100 printers allows for hard copy of the character sets found in Apple's DOS Tool Kit. The Epson version of the software has the added advantage of being able to select either large or small character sizes for each set. This product is designed to be used in conjunction with Applewriter in order to obtain various type fonts on graphic printers. The program is also available for the Silentype and Paper Tiger printers. Requires DOS 3.3, DOS Tool Kit, Applesoft, and supported interface card (Apple parallel, Apple Centronics, and Epson's Apple parallel for the new version). Price: $34.95. Computer Station, 11610 Page Service Dr., St. Louis, MO 63141, (314) 432-7019.
CIRCLE INQUIRY NO. 236

INPUT/OUTPUT

Video controller, VC-100, is designed to the S-100 bus standard. The unit has 80 character by 24 line capability for text processing interfacing into 12 to 15 MHz black and white video monitors with TTL compatable inputs (composite video optionally available). Features include: 128 ASCII character set, hard scroll, reverse video, cursor positioning, 64 character FIFO for keyboard input. A second capability is provided, utilizing the Texas Instruments TMS9918 video display processor. Features on a color-TV or monitor include: 256 by 196 resolution; 15 unique colors and transparent; 16K of video RAM memory; unique planar representation allowing 3-D simulations; three display modes. Application uses include color computer terminals, personal computers, drafting design aids, teaching aids, industrial process monitoring, home education systems, animation aids and

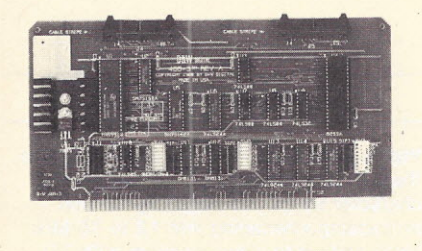
business graphics. Computime, Box 5343, Huntington Beach, CA 92646, (714) 536-5000.
CIRCLE INQUIRY NO. 237

Magnetic tape controller, the RE 5000, for all IEE696 or S100 bus systems includes the operating software that runs under CP/M. The controller will control virtually any ½ in. tape drive from 25 ips to 125 ips and up to 1600 bpi. Both phase



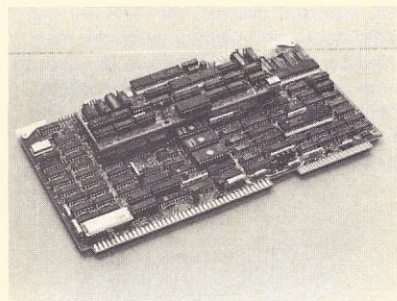
encoding and NRZI are supported. The controller interfaces to a standard tape formatter and only one formatter is required to daisy chain two tape drives. Alpha Data, 417 Welshwood Ave. Suite 103, Nashville, TN 37211, (615) 269-9836.
CIRCLE INQUIRY NO. 238

IEEE-488 interface, 488 + 3, is for S-100 (IEEE-696) computers. The host computer may communicate thru the 488 + 3 to the many plotters, printer, analyzers, analog to digital (A/D), digital to analog (D/A), scientific instruments, etc. that are available with an IEEE-488 interface. In addition, the 488 + 3 incorporates three (3) parallel ports. The interface is implemented through the use of Texas Instruments' TMS 9914. This is designed to provide the interface between the IEEE-488-1975/78 general purpose interface bus (GPIB) and the CPU. The TMS 9914 communicates with the CPU and protocol is handled automatically in



Talker, Listener, and Bus or System Controller operational modes. The software I/O driver routines supplied with the 488 + 3 facilitate its use. They are written in MBasic. These programs are callable subroutines for performing message handling and initialization. The manner in which they have been written allows them to be easily incorporated into a software program. No BIOS modifications are required whether using these supplied subroutines or user generated software. Price for the 488 + 3, IEEE-488 cable and manual: $375. D&W Digital, 1524 Redwood Dr., Los Altos, CA 94022.
CIRCLE INQUIRY NO. 239

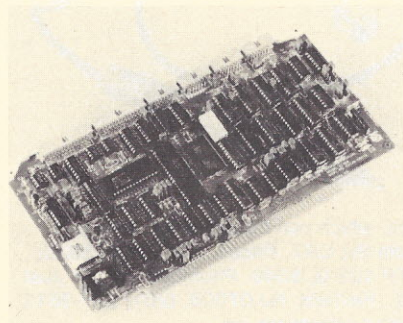
Intelligent controller board, BLC-8545, features on-board communications firmware and two communications I/O channels. It can support IBM's SDLC communication protocol and will have future capability to support the ISO/CCITT-HDLC bit-oriented protocols, IBM's Bisync, and asynchronous start/stop transmission synchronous byte-oriented protocols. Designed for use in Multibus systems, the unit is supplied with its own 8085 CPU, 2K by 8 RAM, 8K or 12K PROM, and multiple bus master capability. Four channels of Direct Memory Access (DMA) provide high-speed communications capability while causing only minimal load on the system's CPU. The two DMA controllers are coupled with paging control to allow channel independent DMA transfers to any of sixteen 64K byte memory pages, and an on-board



programmable interrupt controller allows the board to be used in polled or interrupt driven modes. Baud rates for all channels are under software control with two on-board programmable timers to simplify channel management. The unit is supplied with two channels on-board and two BLX connectors to allow expansion to four channels by plugging in a two channel multiprotocol communications interface BLX module. If four channels are not required, alternative BLX modules may be used to provide other system functions. Price: $1460. National Semiconductor, 2900 Semiconductor Dr., Santa Clara, CA 95051, (408) 737-5000.
CIRCLE INQUIRY NO. 240

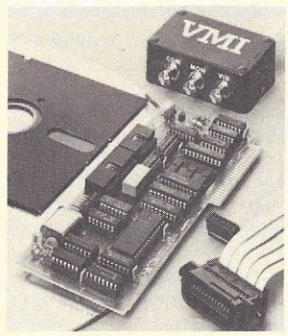
80 column adaptor, circuit board and ROM combination, for Commodore Business Machines' Pet/CBM series computers allows the user to switch between the original 40 column display and the new 80 column display from the keyboard or through program control. Price $275 + $75 for installation. Execom Corp., 1901 Polaris Ave., Racine, WI 53404, (414) 632-1004.
CIRCLE INQUIRY NO. 241

Serial/parallel I/O, model 2718, provides two parallel ports and two programmable serial ports to interface with a large range of peripheral devices. Jumper-selectable data format, phantom for memory overlay, wait states, and invertible handshaking ensure optimum compatibility with a wide variety of systems. Each 8-bit parallel port contains input and output latches and is supported by a full four-line handshaking scheme. The sense polarity of each handshake line is individually jumper-determined for compatibility with the handshaking polarities of the user's peripherals. Any even I/O address can be selected as the parallel ports' base address. The device uses two different programmable serial interface chips: A UART provides asynchronous data transfer with jumper-selectable format options. A USART provides software-controlled and -formatted synchronous or ansynchronous transfer. Data and handshaking lines meet



RS-232-C specifications. The base address of the serial ports' eight registers is jumper-selectable to any I/O address in a multiple of four. California Computer Systems, 250 Caribbean Dr., Sunnyvale, CA 94086, (408) 734-5811.
CIRCLE INQUIRY NO. 242

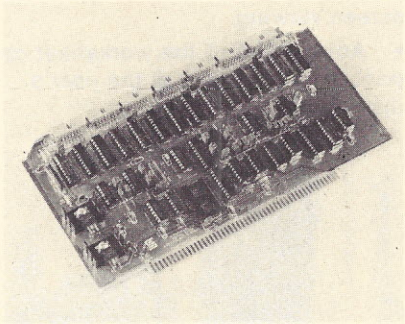
Videodisc interface for the Apple II is a single circuit board that provides a high quality connection (including video switching) between the components. It supports the complete series of the DiscoVision Assoc.' industrial videodisc players, including models PR-7820-1 and PR-7820-2; the SONY LDP-1000 optical, industrial videodisc player; and the Pioneer VP-1000 Laserdisc player (or DVA PR-7810). Package features are: Standard parallel interface. Eight bit bidirectional port, two control lines out, one control line in. For use with the entire DiscoVision PR-7820 series and other devices requiring parallel communication. Standard RS232C serial interface with protocol. Data in, data out; RTS (request to send); CTS (clear to send); DSR (data set ready); and DTR (data



terminal ready). Software selection of asynchronous baud rates at 150, 300, 600, 1200, 2400, 4800, and 9600 baud. For use with the SONY LDP-1000 player, printers, modems, touch panels and other devices requiring RS232C communication. Current pulse, serial transfer interface. For use with the Pioneer VP-1000 Laserdisc player. ROM socket for 2K, 2716 EPROM applications. For example, software drivers for each videodisc player may be encoded on EPROM chips to provide a self-contained interface package to avoid use of the microcomputer's Random Access Memory. On-board rocker switches to select desired

interface options. Price: $575. Allen Communication, 3004 Arapahoe Ave., Boulder, CO 80303, (303) 449-2971.
CIRCLE INQUIRY NO. 243

4-port parallel I/O Interface, model 2720, allows S-100 system users to exchange bidirectional parallel data at high speeds with three peripherals, and to transmit parallel data to a fourth peripheral. Data is transferred at TTL levels on separate 8-bit input and output data pathways and a full 4-line per port handshaking scheme ensures thorough communication protocol of both transmitter and receiver. A status register reflects each port's handshake activity so software



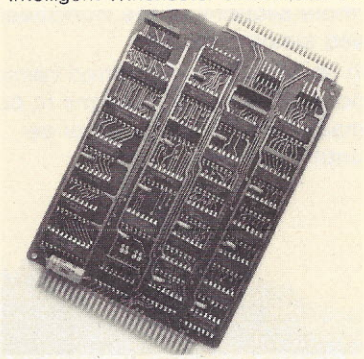
can easily monitor the status of the input and output registers. Designed for flexibility, the system's four parallel ports may be jumper-assigned to any block of four I/O addresses where the base is a multiple of four. The sense polarity of each handshaking line is independently jumper-selectable. The input and output buffers may be individually replaced with readily available inverting buffers. California Computer Systems, 250 Caribbean Dr., Sunnyvale, CA 94086, (408) 734-5811.
CIRCLE INQUIRY NO. 244

PERIPHERALS

Filter/suppressor protectors feature up to 25,000 peak amps, 33.75 megawatts capability protection and subnanosecond suppression response time. Dissipates distortions as heat. Handles virtually all distortion waveshapes, RFI and EMI. AC sine wave distortion smoothing from 0

volts to maximum AC voltage. Failsafe indicator light. Available in plug-in, terminal strip or 18" pigtail units, also OEM models, voltages up to 480V, 50 to 400 Hz. Prices: from $38.88 to $826.50. Electrical Filters, P.O. Box 9087, Salt Lake City, UT 84109, (801) 487-8658.
CIRCLE INQUIRY NO. 245

Winchester controller interface, the SB8740, can choose drive capacities from 5M bytes to over 20M bytes, with a choice of 5¼ in., 8 in., or 14 in. formats. It adapts STD BUS backplane signals to the standard disk controller control/transfer protocol supported by Shugart Associates, Data Technology Corp., and other manufacturers of intelligent Winchester controllers. The

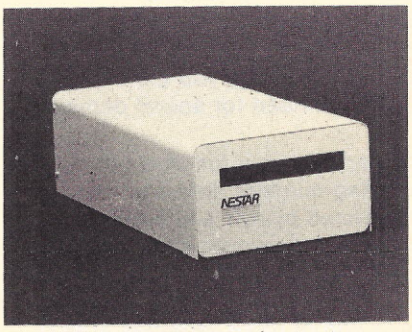


I/O mapped interface includes hardware handshaking, and allows multiple SB8740s, residing in separate STD BUS systems, to share a common set of drives and controller. It can be operated in programmed I/O or interrupt driven modes for minimum cost systems. Price: $150. Illustrated Design Services, 15227 Greenleaf, Sherman Oaks, CA 91403, (213) 789-5836.
CIRCLE INQUIRY NO. 246

Printer attachment is an interface connection to IBM 3274 control unit. The interface, DE 06-13 is available with a coax converter in either RS 232C or Centronics parallel output. The attachment can be

remote or local. This intelligent interface works in an adaptable microprocessing technology. The stand-alone unit has housing and power supply (117V, 60 Hz). Data Electronic, L 11, 18, D-6800 Mannheim 1, W. Germany, telex 463411 del d.
CIRCLE INQUIRY NO. 247

Cartridge tape back-up drive, model A-2401, uses ¼-in. 450 ft. tape cartridges that hold over 20M bytes of formatted data. It works on a Cluster/One model A local computer network. The tape drive operates in the streaming mode, recording 8000 bits per in. of data at 30,000 bytes per second, making it possible to write 20M bytes of data on one cartridge in under 12 minutes. Operating from the Network File Server—a dedicated Apple II computer that controls access to system hard and floppy disk drives for the network—it requires no more than 10 minutes to create or restore a backup tape on Nestar's 16.5M-byte Winchester hard disk. Nestar's streaming drive incorporates two unique, value-added features rarely included in tape back-up systems: 1) an incremental backup and restore feature that permits the user to back up only the sections of the disk that have been modified since the previous back-up; and 2) error checking of data as it is being recorded on tape. This



is accomplished by a system of double tape heads—as one head writes the data, a second head reads and verifies the newly-written data. If an error is detected, a signal is given to rewrite the block in question. Price: $4,275. Nestar Systems, 2585 Bayshore Rd., Palo Alto, CA 94303, (415) 493-2223.
CIRCLE INQUIRY NO. 248

Laser bar code scanner, MS131, has an alphanumeric keyboard, a 32-character display, 48K bytes of battery-powered memory, and full data processing communications capabilities. This unit is a stand-alone, interactive data entry system. With a lightweight scanner head (2.2 lbs) and a compact, battery powered computer console (5 lbs) attached by a shoulder strap, an operator can move about easily. A 4 ft. coiled umbilical cord connects the head to the console. It may also be operated as a tabletop scanning system or

as a fixed head laser scanner. The head can be operated in any position. The depth of field is 4 in., the scan rate is 200 scans per second and the information is almost 10,000 bits per scan. It is capable of scanning symbols that are marginal—either scratched or under plastic. The head contains a safe, Class II BRH hard-seal, steel-ceramic laser with 1.0 mW output of helium-neon light. The model is programmed to read UPC, Code 39, 2/5 Code, Codabar, and other standard codes. Metrologic Instruments, 143 Harding Ave., Bellmawr, NJ 08031, (609) 933-0100.
CIRCLE INQUIRY NO. 249

Financial Planning... from SuperSoft

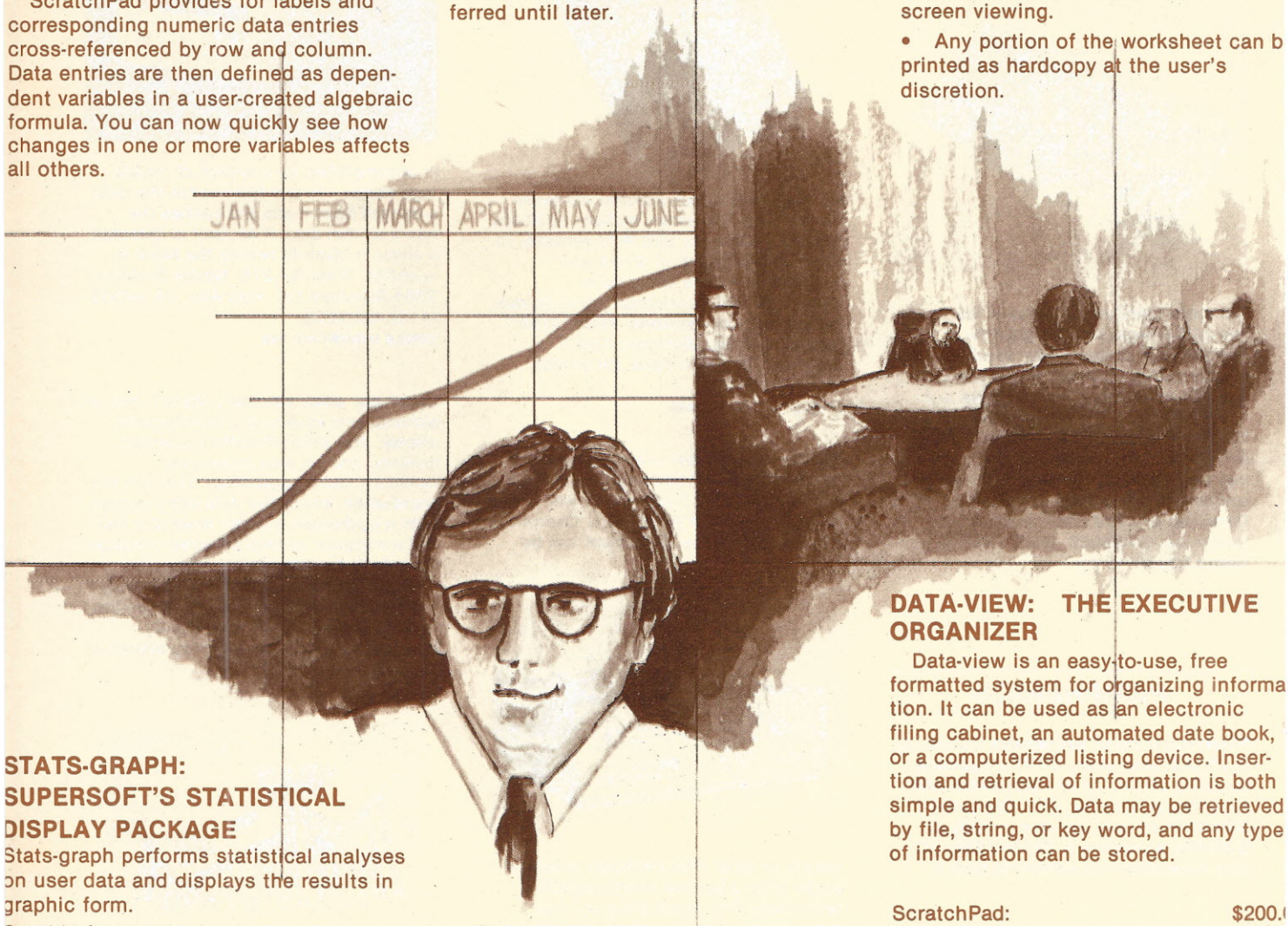
SCRATCHPAD: SUPERSOFT'S ELECTRONIC WORKSHEET

ScratchPad is a user-interactive data modeling program suitable for financial planning or any general purpose modeling. Whether you are an executive, a researcher, or planning the family budget; you will find ScratchPad an invaluable tool in giving you the numeric correlations you need for sound decision making.

ScratchPad provides for labels and corresponding numeric data entries cross-referenced by row and column. Data entries are then defined as dependent variables in a user-created algebraic formula. You can now quickly see how changes in one or more variables affects all others.

ScratchPad includes the following

- Multiple screen splitting which allows two or more sections of the worksheet to be viewed simultaneously.
- Both immediate and deferred calculation modes allowing calculations to be either made as data is entered or deferred until later.
- Flexibility in entry and editing functions so that data can be entered or changed easily.
- Column widths are variable.
- Portions of the worksheet not currently being viewed can be quickly brought to the screen for either single or split screen viewing.
- Any portion of the worksheet can be printed as hardcopy at the user's discretion.



STATS-GRAPH: SUPERSOFT'S STATISTICAL DISPLAY PACKAGE

Stats-graph performs statistical analyses on user data and displays the results in graphic form.

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- Bar Graph
- Scatter Graph

Statistical Analyses include:

- Mean
- Median
- Minimum and Maximum values
- Standard Deviation
- Regression Analysis

Stats-graph is an easy-to-run, user-interactive program that presents valuable and often complex information in a concise and easily understood form.

DATA-VIEW: THE EXECUTIVE ORGANIZER

Data-view is an easy-to-use, free formatted system for organizing information. It can be used as an electronic filing cabinet, an automated date book, or a computerized listing device. Insertion and retrieval of information is both simple and quick. Data may be retrieved by file, string, or key word, and any type of information can be stored.

ScratchPad:	$200.(
Stats-graph:	$200.(
Data-view:	$200.(
Total Package:	$500.(
Manuals only:	$ 15.(

Software available for virtually all CP/M systems. Specify your system.

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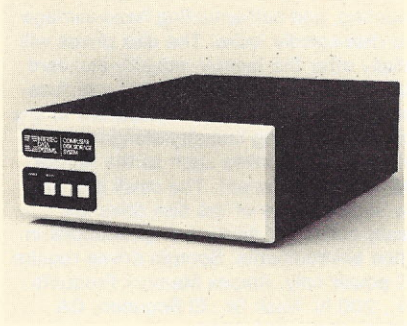
First in Software Technology

Dual disk system and kits for the TRS-80 model III were made by taking the basic 16K model III, expanding the memory to 48K bytes, and adding the MTI double density, dual disk drive system. The system is fully compatible with Radio Shack DOS and peripherals. Price: $1,998. Microcomputer Technology, 3304 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 979-9923.
CIRCLE INQUIRY NO. 250

Adaptor cable allows SuperBrain and SuperBrain QD owners to use the CompuStar 10M-byte disk storage system. This adaptor interconnects directly to the processor board of the SuperBrain microcomputer and the rear data port on the DSS. Once installed, Winchester technology disk storage is provided to any SuperBrain or SuperBrain QD (revision 1.0 or higher). A diskette is supplied with the adaptor cable. This will enable the user to reconfigure the storage allocations on the



disk storage system if desired. The diskette also contains programs that generate new operating systems to permit the SuperBrain and SuperBrain QD to communicate with the DSS. Price: $45. Intertec Data Systems, 2300 Broad River Rd., Columbia, SC 29210, (803) 798-9100.
CIRCLE INQUIRY NO. 251

8-in. Winchester disk drives in the Scorpio line offer increased capacity and performance in a compact design. The family provides the OEM with two versions: model 48 with 49.7M bytes and model 80 with 82.9M bytes of unformatted capacity and 20,160 bytes per track over 823 cylinders. These disk drives offer an average access time of 30 mS with a data transfer rate of 1.2M bytes and an average latency of 8.3 mS by employing a linear voice coil actuator in a closed-loop servo system. Through the use of enhanced 3350 Winchester technology, all critical recording components are enclosed in an

environmentally-sealed module to assure long-term reliability and data integrity. Integrity is further insured through the use of head landing zones, module shock mounting, and self-actuating head-carriage and disk-spindle locks. The disk drives will initially offer the familiar industry-standard SMD interface. The Model 80 is interface-compatible and software-transparent to any host system using industry-standard 80M byte disk pack drives such as the Amepx DM-980 or equivalent. The small size and low audible noise of the disk drive are ideally suited for multi-user applications in office environments. Scorpio drives require DC power only. Ampex Memory Products Div., 200 N. Nash St., El Segundo, CA 90245, (213) 640-0150.

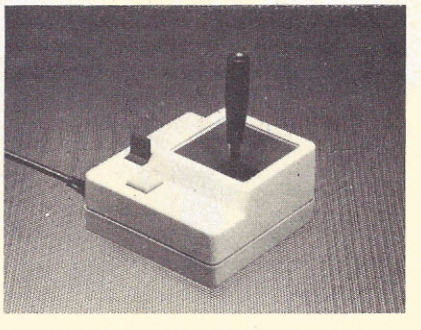
CIRCLE INQUIRY NO. 253

Parallel interface board data handling program is for the Apple II. These interface a paper tape reader and punch to the Apple. The interface is designed for

the model 600-1 punch and model 605 reader. Prices: program—$100, interface—$75. Addmaster, 416 Junipero Serra Dr., San Gabriel, CA 91776, (213) 285-1121.

CIRCLE INQUIRY NO. 252

Input device, Joystick II, is tough enough for child and student use. Clearly coordinated with the Apple computer in color and design, the device will test your horizontal and vertical control skills. The



device's two rugged momentary switches are rated for over one million cycles of operation. Price: $49.95. Keyboard Co., 7151 Patterson Dr., Garden Grove, CA 92641, (714) 891-5831.

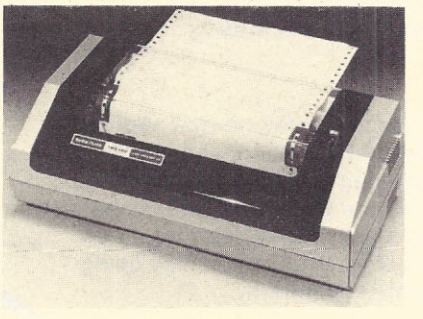
CIRCLE INQUIRY NO. 254

Megabyter system, AMS8000, brings a new dimension to Apple users by making their disk data transportable to other computers. Now users have the opportunity to exchange data with other computers like IBM, DEC, TRS-80, or operating systems like CP/M and UCSD Pascal that typically use 8-in. floppy disks with the IBM 3740 or System 34 format. With a maximum of 4M bytes online, the system provides high storage capacity. A typical system contains two stand-alone 8-in. floppy disk drives and a dual density intelligent floppy disk controller card that plugs into the Apple II I/O bus. The system comes with a deluxe industrial quality cabinet, industry-standard Shugart 8-in. floppy disk drives, dual density controller, self-contained power supplies and high density cooling. A typical system measures 17.5 in. wide, 22.5 in. deep, and 5.5 in. high. Sorrento Valley Associates, 11722 Sorrento Valley Rd., San Diego, CA 92121, (714) 452-0101.

CIRCLE INQUIRY NO. 255

PRINTERS

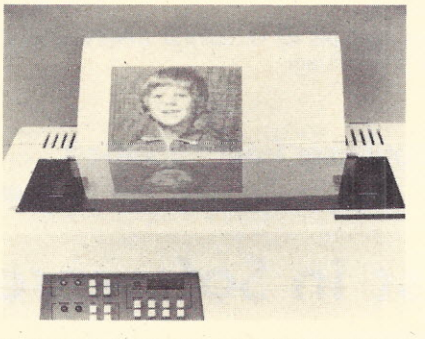
Line Printer VII offers high-quality impact printing and dot-addressable high-density graphics. The device prints either 80 or 40 upper- and lower-case 5 by 7 dot matrix characters per eight-in. line at thirty characters per second. In addition, its dot-addressable high-density (3780 dots per square in.) graphic capability is well-suited to producing a hard copy printout similar in quality to the display on the TRS-80 color computer. The printer uses standard fanfold paper, and features a tractor



mechanism adjustable from 4½ to 9½ in. in width. Switch-selectable standard interface options for the printer include 8-bit parallel (standard for use with most TRS-80 computers), or switch-selected 7-or 8-bit RS-232 serial communications at up to 600 baud. Price: $399. Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102, (817) 390-3272.

CIRCLE INQUIRY NO. 256

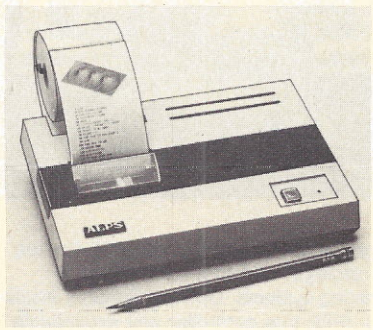
Matrix printer package for DS 180 includes graphics, compressed print, display mode and an expanded buffer. The



dot-addressable raster-scan graphic feature allows the user to print computer-generated charts, graphics, maps and other pictorial

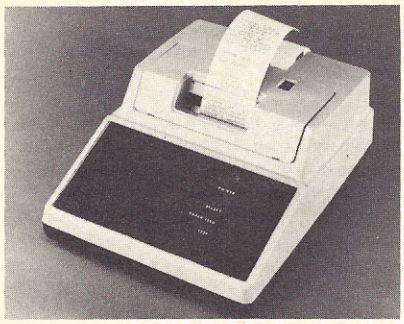
images, which help present data in a concise and easily readable form. Under program control, six individual print wires can be addressed to print high density output at a resolution of 75 dots per in. horizontally and 72 dots per in. vertically. The new option also includes compressed print for variable horizontal pitch selection. Print sizes include 10, 12 and 16.5 characters per in. as well as expanded modes of 5, 6, and 8.25 characters per in. The print size can be selected manually or under program control and stored in the printer's non-volatile memory. Thus, the DS180 can print 132 columns on an 8½ in. form and up to 217 columns on a standard 14⅞ in. form. Price: $150. Datasouth Corp., 4740-A Dwight Evans Rd., Charlotte, NC 28210, (704) 523-8500.
CIRCLE INQUIRY NO. 257

Microminiature alpha-numeric-graphics printer, models 1200 and 1100, use a specially designed ballpoint pen, and may be more accurately said to write, rather than print, all kinds of graphic symbols, including letters, numbers, Chinese ideograms, etc., on standard 2.28 in. (58 mm.) roll paper. It also creates drawings, graphs, etc., directly from programs in the computer. Model 1200 uses four pens, each a different color, to create 4-color graphics. It does alpha-numerics in 15-, 18-, 24-, or 36-column sizes, and writes six characters per second in the smallest size. When creating 4-color graphics, the printer itself selects the appropriate pen, following programmed directions from the computer. Model 1100 uses a single pen and can create alpha-numerics in several sizes from



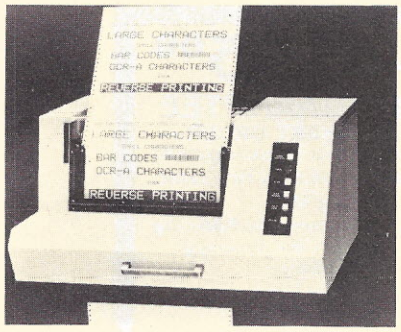
40 to 10 columns per line by changing the program. It writes 12 characters per second in the smallest size. Numbers and letters in the 36 (4 colors)/40 (mono) column size are .059 in. (1.5 mm. or 4.25 pts.) high, and .038 in. (1.0 mm.) wide. An option of expanded sizes will give .236 in. (6 mm. or 17 pts.) by .157 in. (4 mm.) maximum. Complete unit weighs 1.12 lbs. (510 g) and has appearance of a book with dimensions of H. 1.26 in. W. 8.46 in. D. 5.91 in. with power consumption 5 watt. Price: from $325. Alps Electric (USA), 100 North Centre Ave., Rockville Centre, NY 11570, (516) 766-3636.
CIRCLE INQUIRY NO. 258

Dot matrix printer, model 170, is Apple II-compatible and provides 18 or 21 characters per line, 6 lines per in. print density, on standard 2¼ in. adding machine tape. An original plus one carbonless copy can also be printed. This model has been designed for use with personal computers to produce a hard copy of programs, data or results. An optional serial port for RS232C data or TTY (20 or 30 mA current



loop) will be available soon. Standard features include an internal 3-line buffer, ASCII or Baudot input code (switch selectable), upper and lower case characters and an internal clock and calendar, which can be used as an elapsed time indicator. 115/230 VAC 50/60 Hz is standard and a 12VDC power option is available. Price: $299. Addmaster Corporation, 416 Junipero Serra Dr., San Gabriel, CA 91776, (213) 285-1121.
CIRCLE INQUIRY NO. 259

Intelligent dot matrix printer has the capability to image labels and other specialized documents, in addition to normal reports and similar items. Characters may be printed in normal orientation, upside down or sideways, reading from top to bottom or bottom to top, all in normal or reverse printing. Any of the popular bar codes can be imaged as well as horizontal or vertical lines and/or boxes above, below and around other printing anywhere on the document being processed. Bar graphs,



logos and other artwork can be imaged and numeric fields can be easily incremented or decremented. The unit is a 300 line-per-minute printer with a number of protocol emulations and interfaces available. Its power requirements are 110, 60 Hz single phase with limits of +10% and −15%. It can operate in temperatures ranging from 40°F to 100°F and in 20% to 90% humidity (including condensation). Price: $9,550 to $12,700. Data Systems, The Standard Register Company, P.O. Box 1167, Dayton, OH 45401, (513) 223-6181.
CIRCLE INQUIRY NO. 260

80-column serial printers, MT 100 series, feature programmable print fonts and formats. Print speeds range from 100 cps to 160 cps with optimized, bi-directional printing for greater throughput. Models are available using 7 by 7, 7 by 9, 9 by 9 or 40 by 18 character matrices. Output possibilities include graphics, bar code, OCR, condensed or expanded characters,

as well as high-quality correspondence printing. Special plotting modes are available for both bit image control of dot placement and a selectable sequence of graphics characters for producing linear charts and other graphics output. Interchangeable, plug-in interface modules allow the printers to be easily connected to a variety of computers and microprocessor based devices. A 2K buffer with asynchronous serial interface makes the printer ideal for hard copy output from CRTs. Mannesmann Tally, 8301 S. 180th, Kent, WA 98031, (206) 251-5524.

CIRCLE INQUIRY NO. 261

SYSTEMS

Added multi-tasking capability to Commander Computer series lets users gain simultaneous execution of several software processes—like performing data entry operations while supporting on-line data communications, developing software while batch printing, running a business package while updating a data base, and performing concurrent peripheral operations in an industrial environment. The Commander Computer 964+ features 512 by 256 graphics display, dual Z-80A processors, DMA controller, 128K RAM host system, 32K RAM terminal, four RS-232 ports, four parallel ports, RS-170 composite video, four channels of

programmable counter/timer, 800 Kbytes disk storage, and CP/M and MP/M II operating systems. Optional features include APU, IEEE bus controller and expandable disk capacity. Columbia Data Products, 8990 Route 108, Columbia, MD 21045, (301) 992-3400.

CIRCLE INQUIRY NO. 262

Multi-user 16-bit computer, system 8000, is based on an enhanced version of the UNIX operating system and is optimized

for commercial applications. The system uses the Z8000 16-bit microprocessor and

the advanced ZEUS operating system. The system offers an array of high-level languages that presently includes Cobol, Pascal, C and Zilog's own PLZ. Model 20, priced at $29,950, includes the CPU board, two intelligent controllers, 256K bytes of ECC memory, one 24M-byte Winchester disk drive, one 17M-byte cartridge tape drive, eight serial I/O ports and all ZEUS software. Model 30, with 512K bytes of ECC memory and two 24M-byte Winchester drives, is priced at $37,950. Zilog, 10340 Bubb Rd., Cupertino, CA 95014, (408) 446-4666.
CIRCLE INQUIRY NO. 263

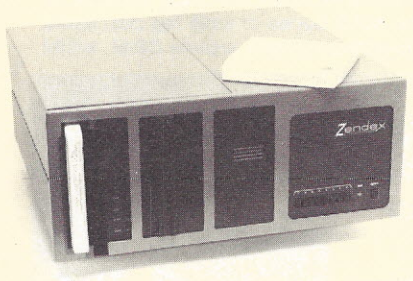
Computer-based engineering work station, features 1M byte of RAM and is designed for hardware and software development, testing and laboratory applications. The system is a display-based, desktop computer around a 16-bit microprocessor. Each engineering work station consists of a compact, lightweight desktop display and detachable keyboard. Mass storage and electronics are located in a floor-standing module that fits under a desk. Up to 16 work stations can be combined, virtually on a plug-in basis, in a distributed intelligence network. For central data base access, individual engineering work stations or clusters of work stations can communicate with a mainframe to upload or download large-scale programs or data bases. For hardware development, the work stations offer five IEEE 796 standard Multibus slots for linking and testing of peripherals and instruments.

The multibus slots help test and debug multiperipheral system configurations, control loops, multiple sensors and instruments for prototype development. The system has 128K bytes of RAM, 10M bytes of Winchester and ½M byte of floppy disk storage. Price: $22,500. Convergent Technologies, 2500 Augustine Dr., Santa Clara, CA 95051, (408) 727-8830.
CIRCLE INQUIRY NO. 264

Multi-tasking desktop microcomputer, Affinity 16, will operate as a stand-alone unit, on-line to a central computer or in a network environment, and can perform batch, on-line or distributed processing applications. The CPU includes a 16-bit microprocessor and 128K bytes of memory. Two minifloppy disks can each record 320K on two dual-sided, double-density disks. up to 2.5M bytes of auxiliary disk storage are available with an 8 in. floppy disk drive unit. An overlay function increases main storage capacity by bringing program subroutines into a main storage area from floppy disks, and deleting them after use. Other productivity aids include an interactive screen format generator allowing the user to create, load, edit, display and catalog screen layouts, eliminating the need to encode input/output formats in Basic programs. Application programs can be created and maintained

interactively with the screen-oriented editor. A full range of utility programs provide a number of valuable functions, including sort, file/volume copy, dump, browse and Linkage Editor. Price: $6,000-$10,000. The TRW-Fujitsu Co., 9841 Airport Blvd., Suite 620, Los Angeles, CA 90045, (213) 535-3821.
CIRCLE INQUIRY NO. 266

Medium-sized business systems will initially include several configurations offering eight- and sixteen-bit CPUs and combinations of floppy, fixed, and removable Winchester hard disk. The 16-bit systems will feature 192K main memory, which can be expanded to 1M-byte. Up to 30M-bytes of hard disk are contained in the integrated



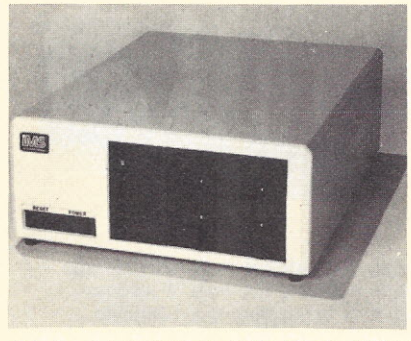
chassis and external expansion storage may be added at any time. A unique feature of the system is a 10M-byte removable Winchester. The removable disk pack can be used for on-line storage as well as a back-up device. Quota, 6680 Sierra Ln., Dublin, CA 94566, (415) 829-1284.
CIRCLE INQUIRY NO. 265

Large Winchester storage is provided in 3032 system. A new Z80b, 6-Mhz micro-processor significantly increases system performance. The model utilizes an 8-in. Winchester disk to provide a formatted 32 million characters of storage, enabling full use of the maximum size files allowed by the CP/M 2 operating system—8 Mbytes per file. The model can use all CP/M-based application and development software including proprietary Memorite III word processing and mail list management, as well as accounting and business communications and ExecuPlan Financial planning and forecasting software. The unit uses DualMode disk controller, which provides automatic error detection and

correction. This technique automatically corrects up to five erroneous bits in every 256 bytes transferred from disk to processor, eliminating errors due to disk contamination, aging, surface defects and all but the most severe disk damage, thus providing a level of security previously found only in large computer systems. The

8-in. Winchester disk and the floppy disk drive are housed in a single desk-top unit (7 by 20.5 by 16.8 in.). System work station is the Vector 3 console with an 80 by 24 character, non-glare screen and keyboard with numeric keypad. Price: $12,795. Vector Graphic, 500 N. Ventu Park Rd., Thousand Oaks, CA 91320, (805) 499-5831.
CIRCLE INQUIRY NO. 267

Table top computer, 5000 SX has integral 5.5M byte Winchester drive. Each unit can also contain two double-sided, double track density floppies. This model represents a massive increase in storage capacity for the 5000 Series of table top computers. Operating systems include CP/M, MP/M,



Single and Multi TurboDOS. Basic, Fortran, and Cobol languages are available. Application programs tailored for the system include FMS-80, Wordstar, plus the complete selection on Accounting Plus packages. IMS International, 2800 Lockheed Way, Carson City, NV 89701, (714) 978-6966.
CIRCLE INQUIRY NO. 268

Personal computer, the ZX81, is based upon an innovative four-chip design. Measuring just 6 by 6.5 by 1.5 in. and weighing 12 ounces, it is highly portable. A new master-chip, custom-built in Britain by Ferranti, replaces 18 chips in the ZX80 and adds new circuitry. The new model has a powerful 8K Basic ROM, enabling it to operate in decimal arithmetic with full scientific functions. Significant new features include the model's ability to operate in two software selectable modes, FAST and NORMAL, FAST being four times the speed of NORMAL. In NORMAL, the model will both compute and display simultaneously, which allows continuously moving, flicker-free graphics. A 40-key touch-sensitive membrane keyboard gives

the equivalent of 91 keys using function mode and single-press key-word system. Graphics mode enables an additional 20 graphical and 54 inverse video characters to be entered directly from the keyboard. The graphic display can also be divided into 64 by 44 pixels. Price: $149.95. Sinclair Research Ltd., 2 Sinclair Plaza, Nashua, NH 03061, (617) 451-0450.
CIRCLE INQUIRY NO. 269

68000 based microcomputer, Q1 68000, can now operate with the CRTs of most manufacturers and almost all available RS-232 printers. Furthermore, the system can now be configured with up to 68

RS232 ports. The basic system consists of a floppy disk, a Winchester hard disk with tape cartridge backup, and the computer—all housed in a standard 19-inch rack. The Winchester hard disk has a storage capacity from 10-800 Mbytes (33 Mbytes is standard). The 8-in. IBM-compatible floppy disk drive is provided with complete support software to enable media from IBM and CP/M to be converted. The floppy disk drive is also used for field service and test programs. The 8-MHz 68000 processor uses a 16-bit external data bus and as a 32-bit internal data path. The system can have up to 14M-bytes of external memory. To provide a protected environment, the processor is coupled to a high-performance memory mapper. A 256K-byte memory is included with the basic system, but the 8-card cage can accept an additional 3M bytes of memory. An 8-color 80 by 24 14-inch CRT display is standard; black and white, full page, and plasma displays can be provided as options. A 100-station keyboard with N key rollover, numeric pad, and function keys is standard, and 45 cps to 600 lpm printers can be used. Q1 Corp., 125 Ricefield Ln., Hauppauge, NY 11787, (516) 543-7800.
CIRCLE INQUIRY NO. 270

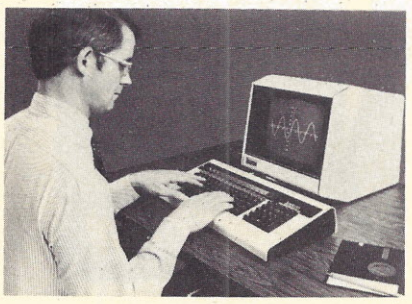
TERMINALS

Computer terminal, Xycom 4815-D52, is designed to emulate the DEC-VT52 and also to survive in hostile environments. The terminal allows DEC-based systems to be installed or extended into environmental areas that would kill standard terminals. The system is a non-ventilated, gasketed, industrial terminal for dusty, dirty environ-

ments where temperatures may vary from 0°C to 50°C and system interruption or high terminal maintenance costs are significant factors. The unit may be used singly or in multiples in DEC systems with or without one or more DEC VT52 terminals connected. It has a standard RS-232C

interface. The terminal enclosure of GE Noryl meets general NEMA 12 specifications (dust tight, drip tight, etc.) Its sealed membrane keyboard provides a key stroke area and key spacing, which allows an operator to use it while wearing gloves. Tactile as well as audio feedback indicates when a key has been depressed. Standard features include self-test on power-up, 12 in. display, and full ASCII character set. Numeric and curser control keys are repeating. The display format is 80 characters/line by 24 lines. The character format is a 7 by 8 dot matrix in an 8 by 10 window. The industrial-quality terminal is intended to be used as a plant floor information center or operator work station, Xycom, The Hard Hat Computer People, Box 984, Ann Arbor, MI 48104.
CIRCLE INQUIRY NO. 271

Microprocessor-based video display system, Lexiscope 4000, has intelligent graphics and alphanumeric display. The system provides medium-resolution monochrome graphic display using raster scan technology with a 560 by 500 fixed resolution. The system's firmware provides easy-to-use graphic capabilities, such as vector generation, selectable plotting modes and line styles, elastic line plotting aids and graphics text with multiple sizes, styles, and orientation. The system also



contains a full-featured alphanumerics display capability with separate memory that may be used and enabled independently of the graphic display. The system is specifically designed as an add-in subsystem for any Nova or Eclipse computer. Its microprocessor-based controller plugs directly into the mainframe of the host computer, providing efficient, high-speed communication between the host and the display. Price: $3,400. Lexicon, 60 Turner St., Waltham, MA 02154, (617) 891-1227.
CIRCLE INQUIRY NO. 272

Visual display terminal, Soroc IQ 130, incorporates screen editing, full video attributes, 14 programmable function keys, protected fields and a 25th status line with a 36 character user message. Block and conversational modes are standard at selectable transmission rates from 110 to

19,200 baud. The flexibility of Z-80 technology allows the user to change many of the operating characteristics of the unit. Line graphics capability is offered as an option. Price: $699. Soroc Technology, 165 Freedom Ave., Anaheim, CA 92801, (714) 992-2860.
CIRCLE INQUIRY NO. 273

Display / S-100 unit is designed to link the Sorcerer computer to all the manufacturers of S-100 bus products. The unit combines the expansion capability of S-100 products within an enclosure that houses the video display for the computer. The Display / S-100 unit is mounted on a swivel base stand and includes a 12 in. professional CRT with 20 MHz bandwidth for high resolution and a green P31 phospor. The S-100 bus is a self-contained S-100 mother board with power supply and

translation logic for the Sorcerer computer. S-100 capability enables Sorcerer computers to interface to a host of S-100 products including analysis and recording of scientific data, control test equipment, monitor production line 3, process control, super graphics, mass memory expansion, communications and speech synthesizers, to name a few of the possible extensions. Marketing Communications, Exidy Systems, 1234 Elko Dr., Sunnyvale, CA 94086, (408) 734-9831.
CIRCLE INQUIRY NO. 274

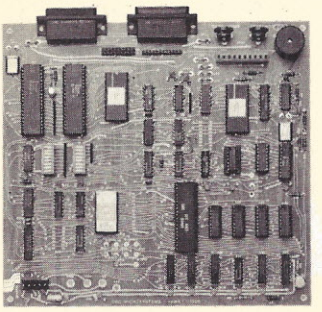
Voice entry terminal, Shadow/VET interfaces directly with any Apple II computer. Somewhat smaller than the VET/2 (at 1½ in. high by 6⅛ in. wide by

8⅝ in deep), the terminal is operationally similar. It is linked functionally to the Apple keyboard for easy use, and the operator

can utilize keyboard input or voice input at any time. The terminal is supplied with pre-processor, interface board with 16K onboard RAM memory, software, noise-cancelling headset microphone, and operator's manual. Price: $995. Scott Instruments, 1111 Willow Springs Dr., Denton, TX 76201, (817) 387-9514.
CIRCLE INQUIRY NO. 275

Video display terminal, D81, is a buffered editing system that operates in either conversational or block mode. The terminal's alphanumeric keyboard employs an IBM Selectric typewriter-like layout so often demanded by today's terminal operator because of familiarity. The terminal accentuates operator comfort with a non-glare display and non-glare key top that eases eye strain. The unit operates quietly because it has been designed to function without cooling fan. The keyboard is also equipped with fast repeat-type keys that enable rapid data entry and a numeric pad section. Separate keys control the movement of the switch-selectable cursor that can operate in block or underline, blinking or non-blinking modes. The unit has a data format of 24 lines by 80 characters, plus a top status line of 80 characters for a total of 2000 displayable positions on the 12-in. diagonal screen. The character format is a 6 by 8 dot matrix in a 7 by 10 field. The terminal has reverse video, blink, blank, underline and half intensity features—all program or operator-selectable. Protected fields appear at half intensity and cannot be changed when in the protect mode; only non-protected fields can be transmitted. The terminal is available in a standalone configuration, and automatically self-tests the program ROM, display, data RAM, and loopback of serial interface when powered up. Price: $1,249. Ampex Corp., 200 N. Nash St., El Segundo, CA 90245, (213) 640-0150.
CIRCLE INQUIRY NO. 276

Smart CRT terminal board, Hawk 1, provides all the electronic hardware and software functions necessary to implement a smart CRT terminal. All the user need do to configure a complete 80 column by 24 row display terminal is to connect a keyboard, an 18.6kHz monitor and a power supply to the board. The display interface provides either separate horizontal, vertical, and video TTL signals or composite video for the user-supplied monitor. The board provides extensive editing features, such as character insert/delete, line insert/delete and full/partial screen erase. Several video attributes are also available, including underline, reverse video, character blinking, half-intensity and character blanking. A set of 64 graphics characters allow mixed



alphanumeric and graphic displays. Price: $425. Standard Microsystems Corp., 35 Marcus Blvd., Hauppauge, NY 11788, (516) 273-3100.
CIRCLE INQUIRY NO. 277

Ten new standard features for the 132-column model 100 CRT terminal, include those that make it a VT132 (as well as a VT100) emulator. Block mode and full editing are two of the major features added to the model. Others include half-duplex (in addition to full) communications, forms transmit, protect mode (with a protect attribute independent of the six hidden display attributes), and the ability to execute or transmit user-programmable functions when on line. Other model total-performance features include a 3,168-character page display, bi-directional peripheral port, 256-character input buffer, four smooth scroll rates, screen saver, monitor mode, and a 880-character, non-volatile function memory (20 user-programmable functions, on dedicated keys). It is ANSI X3.64-compatible, and consumes less than 40 watts of power. The model's ergonomic features include -

detached keyboard, non-glare display, white, green or amber screen, 12 or 15 in. CRT, audible key click, optional tilt base, and a choice of enclosure styles. Plus, it utilizes an 18.6 KHZ horizontal scan rate, resulting in high character resolution. Price of the "new" model 100, as shown, remains at $1,745. Delivery is quoted at 4 to 6 weeks. Teleray, Research, Inc., Box 24064, Minneapolis, MN 55424, (612) 941-3300.
CIRCLE INQUIRY NO. 278

SOFTWARE

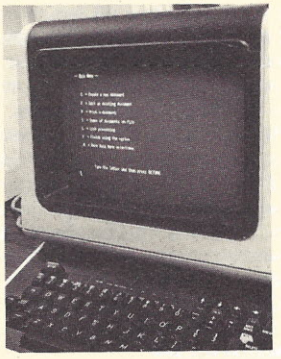
BUSINESS

Multi-purpose business package, The Formula, can create, maintain, update and modify data base files; develop data entry routines simply by describing the data to be stored; implement user-defined menus for straightforward, simple and rapid job throughput; sort data base elements by any field or combination of fields; and generate free-format reports by typing a sample of the report desired using the word processing characteristics. Reports can readily be written with multiple file access on any number of files. Reported data can be manipulated arithmetically or logically during report generation to produce new headings when a data characteristic changes, sums, averages, squares, square roots, moving averages, deviation from a constant or variable, counts of the number of entries within given ranges. Text highlighting and underlining in reports are standard features and any other special printer command can readily be added. The flexibility of the software report structure permits the user to compress files easily by facilitating the use of data codes. Shortened codes representing various record entries can be stored in files, then de-coded into actual data through the use of a second file as a lookup table. The package will automatically replace codes in reports. Included with the package is a sophisticated general accounting system, including accounts receivable, accounts payable and general ledger. Available on all Z80 or 8080 based microprocessor systems running CP/M or Cromix. Price: $595. Dynamic Microprocessor Assoc., 545 Fifth Ave., New York, NY 10017, (212) 687-7115.
CIRCLE INQUIRY NO. 279

Statistics package, Daisy, for the Apple II, offers a full range of statistical capabilities and user conveniences. The software is suitable for business, scientific and social science applications. Features include: full user assistance facilities HELP and INFO, math and time-series transforms, hi-Res plots, basic statistics (mean, standard deviation, etc.), correlations, multiple regression (six different procedures), model testing and evaluation, nonparametric statistics, hypothesis testing, and analysis of variance. Users can add their own programs as new Daisy commands. Disk commands exist to save, enter, examine and overlay of variables or hundreds of observations; the default is 10 by 272. Data entry is through a "window" view into the data table. Requires Apple II 48K with Applesoft in ROM, and DOS 3.3. Price: $79.95. Rainbow Computing, 19517 Business Center Dr., Northridge, CA, (213) 349-0300.
CIRCLE INQUIRY NO. 280

Financial program, Desktop/Plan III, enables users to do financial analysis and modeling on the Apple III. The program takes full advantage of the extra internal memory, higher resolution graphics, five million bytes of hard-disk mass storage, and other features of the recently improved Apple III. The program may also receive data from the Personal Software VisiCalc program. This is an enhanced version of the Desktop/Plan II program, which continues to be available for the Apple II computer. It permits business-people and other managers to do analyses and financial modeling. Both programs are menu driven—they prompt the user through the process of describing, designing and executing a financial model. Other improvements of the current program over earlier versions include faster disk access and use of the hard-disk system. Requirements include an Apple III 128K system, at least one storage device external to the computer, hard-copy printer and video display. Price: $300. Personal Software, 1330 Bordeaux Dr., Sunnyvale, CA 94086, (408) 745-7841.
CIRCLE INQUIRY NO. 281

Word processing software package, CT*OS, runs under a variety of operating systems, including its own operating system



for single terminal use, RSTS/E, RSX-11M and VAX/VMS; thus allowing it to operate in the full range of DEC LSI-11, PDP-11 and VAX systems. Functions include global search and replace, cut and paste files, list processing, ASCII file handling, 132 column document width, stored text libraries, right justified margins, sub and superscripts, centering, automatic pagination, and a powerful nesting arrangement of user defined keys to invoke user written subroutine-like operations. Price from: $2,200. Compu-Tome, 234 E. Colorado Blvd., Pasadena, CA 91101, (213) 960-2895.
CIRCLE INQUIRY NO. 282

Inventory management system for stock control is designed to offer a complete and current overview of stock with minimal effort by the operator. Detailed information on any item can be gained instantly. The program can be used on an Apple II microcomputer with a 48K disk. The manual part of the package is written for the novice and comprised of four main sections: Introduction, practice run, reference and appendices. The introduction details the system's hardware requirements and explains the system's terminology. The practice run is designed to familiarize the user with many of the system's features and functions. The reference section provides detailed technical information on all of the system's features and functions, including a collection of tips and suggestions so the system's capacities can be fully utilized. The appendices provide many examples of the system's capabilities and other useful materials. Price: $175. Hayden Book Co., 50 Essex Street, Rochelle Park, NJ 07662.
CIRCLE INQUIRY NO. 283

Graphics and forecasting analysis package, Trend-Spotter, is designed for the Apple computer. It will generate color graphic displays, calculate and display trend lines, perform mathematical and statistical computations, print graphic and tabular data, edit and update data files. It has the capability to both generate and read VisiCalc-compatible files. System requirements include an Apple II + computer (48K RAM with Applesoft Basic), disk drive and monitor. A second disk drive and printer are optional. Price: $175. Software Resources, 186 Alewife Brook Pkwy., Suite 310, Cambridge, MA 02138, (617) 497-5900.
CIRCLE INQUIRY NO. 284

All-points-addressable graphics package for the Microline family of printers will enable users to address a dot anywhere on the printed page to create illustrations with even, flowing lines. This form of graphics gives users a resolution of 60 horizontal dots by 66 vertical dots per in. A software algorithm, which is included with the package in the form of a floppy diskette, allows users to easily translate data displayed by an Apple computer into parallel data that can be used by the Microline printers. An Apple computer displays data in a format of 280 by 192 dots per square in. The package is available for the Microline models 82A and 83A currently being sold. As a standard feature on the model 84, the package provides users with a resolution of 72 dots by 72 dots per square in. The package available for the 82A and 83A consists of two programmable read-only memory modules and a floppy diskette, and can be easily installed. Price: $100. Okidata Corp., 111 Gaither Dr., Mt. Laurel, NJ 08054, (609) 235-2600.
CIRCLE INQUIRY NO. 285

Joystick/paddle graphics package, Graphics Composer, works on the Atari 400/800 Computers. With this package, paddles or joystick can be used to draw a picture outline on hi-res screen Mode 8 or 7. Then use color fill-in, color brushes and add text to complete your graphic designs. It allows easy creation of Player Missile shapes that may be used in other programs. The Geometric Figures program lets the user define circles, triangles, polygons, parallelograms and trigonometric curves. Loading routines are provided so that pictures can be used in other programs or traded with friends. It requires 32K RAM. Price: $39.95. Versa Computing, 3541 Old Conejo Rd., Suite 104, Newbury Park, CA 91320, (805) 498-1956.
CIRCLE INQUIRY NO. 286

Jobs Accounting Management System is designed to meet the special needs of architects and engineers. The system tracks projects from original budget estimates to completion, paying special attention to time devoted to each activity. Budgets, labor costs, expenses and total billings to date all are stored in JAMS' job files, allowing the user to determine profit by job and by client. Once a budget for

each job is determined, employee time sheets can be entered on a daily or weekly basis and job histories can be kept for all hours spent on each project—a crucial element of billing in most architectural and engineering offices. Records designed to detail all jobs assigned to each employee also can be stored in the history files. Each job file also contains expenses posted from accounts payable, with an option to list the expense as reimbursable. JAMS then provides a suggested bill by client and by job, listing all hours expended and all expenses considered reimbursable. From the suggested bill, architects and engineers then can decide how to finalize invoices, which are automatically posted to the accounts receivable file. Price: $4,500. Microtech Business Systems, 3180 Pullman St., Costa Mesa, CA 92626, (714) 557-8640.

CIRCLE INQUIRY NO. 287

DATA COMMUNICATIONS

Communication program, Move-It allows transfer of programs and data files between any two computers running CP/M, CP/M-86, MP/M or MP/M-86. A program is supplied to configure the program for most popular microcomputers, even with incompatible disk formats. It can be used as an "electronic mailman," sending letters and correspondence over standard phone lines, between various offices of a company. Branch offices, salesmen in the field or warehouses can send up-to-the-minute information to the corporate headquarters. In addition the program also supports interoffice communication. The program is able to display both local and remote directories, as well as to send or get files from a remote computer without remote operator assistance. Price: $99.95 plus $2 shipping and handling. Woolf Software Systems, 23842 Archwood St., Canoga Park, CA 91307, (213) 703-8112.

CIRCLE INQUIRY NO. 301

Telecommunications software, I/Term, provides for off-line data entry, editing and pre-processing for remote computer service or time-sharing users. In most cases connect and processing costs can be reduced 50% to 90%. The program has provisions for communicating between your computer and any timesharing system. It allows you to receive to or transmit from your disk without special timing or operator commands. It can receive data with no pauses, no loss of data, and no special operator conditions. Installation programs and drivers for Cromemco System 2 and 3, TRS-80 II, North Star Horizon and many others are included. Most modem cards and serial cards with interrupt capability may be used, or a real time clock may act as a polling clock. InfoSoft Systems, 25 Sylvan Rd. So., Westport, CT 06880, (203) 226-8937.

CIRCLE INQUIRY NO. 302

Network capabilities are available with MultI/NET. This addition to the MultI/OS, UNI/OS and I/OS systems broadens line of 8080/8085/Z80 operating systems to cover the full spectrum of functions from single-user through single-CPU multi-user to complete network containing any mix of single-user and multi-user CPUs. Standard facilities include: directory; sub-directory; remote task; password protection; inter-unit file transfer; multiple printers both local and remote; file sharing; record/file lock; remote disk; directory assigning; and remote spooler control. InfoSoft Systems, 25 Sylvan Road South, Westport, CT 06880, (203) 226-8937.

CIRCLE INQUIRY NO. 303

Communications package, Micro-Link, will use the RS-232 port on the Osborne 1 with a standard modem. Files may be prepared in advance and transmitted automatically. The entire two-way record of communication may be recorded in memory and on diskette. Features include: readable word-wrapped display fitted to any screen width, a host of options with convenient default settings, and simple, fast user commands. It has the ability to interface to data bases, bulletin boards, and time-sharing services, recording segments that interest the user for later review off line. It can also be used as a remote terminal for other computers. It supports originate and answer mode, full and half-duplex, and operates at 300 baud. Files may be transmitted in character, line, or memory block protocol. Hardware required includes: Z-80 or 8080 based computer system with serial port and standard RS-232 modem. Minimum memory is 16K (program uses 4K). Operating system is CP/M 1.4 and up. Price: $89. Osborne Computer Corp., 26500 Corporate Ave., Hayward, CA 94545, (415) 887-8080.

CIRCLE INQUIRY NO. 304

Electronic mail package, Micro-Courier, allows owners of Apple II desktop computers to rapidly transmit charts, graphs, correspondence, VisiCalc reports and entire programs to other Apple computers over standard phone lines. These transmissions can be sent automatically, allowing the owner to take advantage of low night phone rates. Using these rates, the package can send 1,000 words of text in one minute for less than a quarter. The system also saves labor by maintaining phone lists and sorting messages by individual user. Price: $250. Microcom, 89 State St., Boston, MA 02109, (617) 367-6362.

CIRCLE INQUIRY NO. 305

PERSONAL

Mind Thrust is a mental stimulation game that combines skill and luck as you compete against the computer and try to complete an unbroken chain across the playing board. The strategy is simple: out-maneuver and out-guess your opponent, the computer. At each turn, a player must choose to either add a link to his chain or attack the opponent's chain to make is shorter. As a special feature, a player may switch sides with an opponent at any time and gain control over the opponent's pieces. Since the computer has many random features, every game is a new one. It requires a TRS-80 level II with 16K. Price: $16.95. Hayden Book Co., 50 Essex Street, Rochelle Park, NJ 07662, (800) 631-0856.

CIRCLE INQUIRY NO. 307

Super Stellar Trek for the Apple computer is a high-resolution, color, real-time action game. In addition to the features of the Stellar Trek game, it has increased speed, a one-stroke display change, improved visual displays, more sound effects and ion storms. The program comes with a complete operation manual. It requires 48K bytes of memory, Applesoft in ROM and either DOS 3.2 or 3.3. Price: $39.95 on floppy disk. Rainbow Computing, 19517 Business Center Dr., Northridge, CA 91324, (213) 349-0300.

CIRCLE INQUIRY NO. 308

Interactive adventure game, Voyage of the Valkyrie, involves graphic realism and intricate audio soundtracks. Those successful in finding the 10 castles on the voyage can document their progress on a map of the Island of Fugloy and receive a full color wall poster entitled Valkyrie. The program involves an exploration of the Island of Fugloy's mountainous terrain with a goal of seeking the proper mountain passes to reach the castles. Developed for the TRS-80 models I and III in diskette and cassette and for the Apple in diskette only; 48K with paddles. Price: $39.95. Advanced Operating Systems, 450 St. John Rd., Michigan City, IN 46360, (219) 879-4693.

CIRCLE INQUIRY NO. 309

Attendance Reporting System provides reports needed by elementary and secondary schools to account for student absenteeism and tardiness. It can accommodate a school of any size and provides eight user-defined absence categories, such as illness, medical appointment, etc., to meet the school's particular internal and external reporting requirements. Reports include the daily attendance report, the individual student history report, a variety of homeroom summary reports and homeroom rosters. Summary reports may be for any date range and may be organized by student or date. They include total absences, total unexcused absences, total excused absences, duration of current absence and subtotals for user-defined absence categories. The system is for the Apple II with 64K, two 16-sector 5-in. disk drives and printer. Price: $550. Educational Services Management Corp., Dept. M, Box 12599, Research Triangle Park, NC 27709, (919) 781-1500.

CIRCLE INQUIRY NO. 310

Counting Bee introduces young learners (ages 3-6) to counting, addition, subtraction, shape discrimination, weight and measurement. The system features a learning management mode, which allows parents and teachers to preset the system, with emphasis and duration tailored to an individual child's needs. It uses Applesoft, 48K, DOS 3.2 or 3.3. Price: $29.95. Edu-Ware Services, 22222 Sherman Way, Suite 203, Canoga Park, CA 91303, (213) 346-6783.

CIRCLE INQUIRY NO. 311

SYSTEM

Package of software instruments, Unica offers many of the facilities and commands of UNIX to the CP/M user. All commands support redirection of standard I/O, connection of subsequent commands via pipes, extended filenames with user numbers, and wildcard filenames based on pattern-matching rather than character-masking. The commands include sr, which searches multiple files for a pattern in a grep-like fashion; sp, a spelling error detector with a 20,000 word dictionary; ln, which forms links (aliases) to files; sc, a source file comparator with resynchronization; srt, a file sorter; ls, an intelligent directory lister; cat and hc, which do vertical and horizontal file concatenation; dm, a disk map utility; and several others. The Unica commands are written in XM-80, which allows the versatility of assembly language while providing high-level procedure constructs. A Z80 system running CP/M version 2 or later is required. Price: $95. Knowlogy, PO Box 283, Wilsonville, OR 97070, (503) 635-5701.
CIRCLE INQUIRY NO. 318

Single-user operating system, DOS 3.26, is an enhanced version of CP/M 2.2, currently offered by Digital Research. The operating system is a complete implementation of the CP/M 2.2 operating system. Dynabyte has implemented CP/M 2.2 around a modular architecture. Each module in the sytem is designed to support one portion of the product line. This allows the operating system to be easily tailored for a wide variety of terminals, printers, memory, floppy and hard disks. The system will also allow up to four consoles and four printers to be attached and configured. Only one console or one printer may be active at a time, but up to four may be installed with the DYNASYS program. Utility programs are provided to easily transfer control between any of the four devices. Application programs can also easily switch between printers. Dynabyte Corp., Menlo Park, CA, (415) 329-8021.
CIRCLE INQUIRY NO. 319

Data base processor, the Z65, for the Apple consists of both hardware and software: a Z80 CPU, a 6502-Z80 software interface, and a Z80 implementation of MDBS. Price: $1,600. Micro Data Base Systems, Inc., P.O. Box 248, Lafayette, IN 47902, (317) 448-1616.
CIRCLE INQUIRY NO. 320

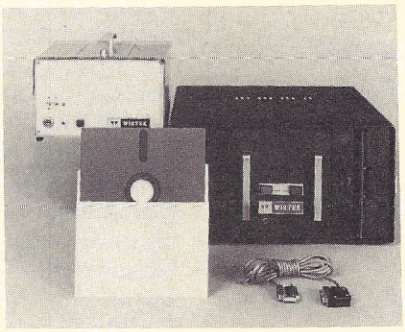
68000 cross assembler for FLEX and UniFLEX operating system from Technical Systems Consultants, accepts all of the standard Motorola instruction mnemonics with the exception of certain suffix variations to some root mnemonics. All expressions are evaluated to a full 32 bits before any required truncation. Numerous directives or options permit page formatting, titles, subtitles, listing control, object code output control, sorted symbol table listing, line numbering, auto field formatting, warnings, command line parameters, inclusion of separate source files, and setting of even word boundaries. The assembler also supports conditional assembly and macros. Object code is output in Motorola S1/S2/S8/S9 records of ASCII hexadecimal data. Price: $250. Technical Systems Consultants, P.O. Box 2570, West Lafayette, IN 47906, (317) 463-2502.
CIRCLE INQUIRY NO. 321

UTILITY

Polite mediator between the operator and CP/M, Supervyz, enables an entry level user to immediately employ CP/M's full capabilities. Under its guidance, users can select programs, execute them, and perform all necessary file and disk support functions with one or two keystrokes. Detailed help messages are available whenever the operator requires additional assistance. Price: $95. Epic Computer Corp., 7542 Trade St., San Diego, CA 92121, (714) 569-0440.
CIRCLE INQUIRY NO. 327

CP/M utility program, Recover, permits CP/M users to recover files that have been erased and will work with all versions of CP/M on both hard and floppy disk systems. The utility is supplied on an 8 in. single density floppy disk. Price: $75. Southern Systems, 586 Shades Crest Rd., PO Box 3373A, Birmingham, AL 35255, (205) 933-1659.
CIRCLE INQUIRY NO. 328

Hardware/software options to the Sprint 68 microcomputer/development system include: BOOT-II monitor/debugger/ bootstrap ROM with mnemonic instruction display; DOWNLOADER for automatically downloading applications programs from the system to a target computer; PROFILER



for histogramming the relative amounts of MPU time required to execute various parts of a program; DISK PATCH for manipulating physical disc sectors; DEVICE DRIVER LOADER for installing user defined drivers. Price: $295. Wintek Corp., 1801 South St., Lafayette, IN 47904, (317) 742-8428.
CIRCLE INQUIRY NO. 329

Disk recovery system, DPATCH, provides the computer user with the ability to recover files that contain I/O errors, recover the use of disks and diskettes that have error tracks and additionally recover files that have been accidentally or maliciously erased for the disk directory. Using this system, the computer user has an automatic recovery vehicle to extract data from files that are no longer readable under normal circumstances. In addition, the particular media in error can be returned to normal use following system Surface Analysis, which analyzes the damaged area and precludes any further use of only that area. Price: $195. Advanced Micro Techniques, 1291 E. Hillsdale Blvd., Suite 209, Foster City, CA 94404, (415) 349-9336.
CIRCLE INQUIRY NO. 330

Directory formatter software, DIRECTORY MASTER, is a fast machine language utility for the Apple II that lets you directly customize your disk catalogs for a unique and professional look. This easy-to-use program allows you to create attractive diskette headers and catalog titles containing normal, inverse, flashing and/or control characters. Any number of file names may be sorted alphabetically or reordered. File names may be hidden, so that they cannot be seen when the disk is cataloged. In addition, this program lets you recover files that have been accidentally or intentionally deleted from a disk. Any range of files may be locked, unlocked or deleted with just a few keystrokes. Files may also be expunged from the disk, wiping the disk clean as if they had never existed. Best of all, the program writes all changes directly to the disk being modified, eliminating the need for initiating a new disk or creating superfluous POKE files. The program is written in Applesoft, and requires an Apple II Plus (or an Apple II with language card or Applesoft in ROM), and works with either one or two drives. Separate versions are available for DOS 3.2.1 and DOS 3.3. Price: $39.95. Micro-Sparc Systems, Box 325, Dept. P, Lincoln, MA 01773.
CIRCLE INQUIRY NO. 331

Feature program on the DMM-1 utility software disk, XDIR, displays the disk directory file names in alphabetic order and alos shows the file size for each file name. A disk usage summary is provided reporting the number of bytes on the disk, the number of file names in use and the space used. It also reports the number of available file names and space. The program works on single density and double density floppy disks as well as with hard disks. Also on the disk: EXTRACT, STRIP, SORT, CONVERT and STATUS. DMM-1 comes on an 8-in. single density disk or on a 5¼-in. disk for North Star CP/M users. Price: $35. Elliam Assoc., 24000 Bessemer St., Woodland Hills, CA 91367, (213) 348-4278.
CIRCLE INQUIRY NO. 332

Professional programming aid, Advanced X-tended Editor, provides the user with a text-editor style extension to the standard Applesoft operating system. AXE operates along with DOS, Monitor and Applesort, remaining transparent to the user until called upon by one of over thirty commands. Features include GLOBAL SEARCH/ REPLACE, CHARACTER and STATEMENT INSERT/DELETE modes, AUTO LINE NUMBER, two PACKED EDITING modes, RECALL EDITING modes, programmable keyboard MACROS, four list formats, and enhanced cursor movement. All commands work in normal Applesoft and AXE's edit modes. AXE requires 48K, disk drive (DOS 3.3) and Applesoft. Price: $69.95. Versa Computing, 3541 Old Conejo Rd., Suite 104, Newbury Park, CA 91320, (805) 498-1956.
CIRCLE INQUIRY NO. 333

Free Literature

The Softwaire Newsletter is a bi-monthly publication of The Softwaire Store, Los Angeles, CA. The newsletter features the latest news in personal and business CP/M software. The newsletter also reviews the newest microcomputer books, magazines and games. Softwaire Store, 11768 West Pico Blvd., West Los Angeles, CA 90064.

CIRCLE INQUIRY NO. 201

Blank keytops stocked for computers, video display terminals and point-of-sale terminals are detailed in catalog. These blanks can then be engraved (on top and/or side faces) to customer specification. Arkay Engravers, 2073 Newbridge Rd., Bellmore, NY 11710, (516) 781-9859.

CIRCLE INQUIRY NO. 202

What's A Small Business Computer, Anyway? describes the vital steps involved in selecting a small business computer, explained in easy-to-understand terminology. The pamphlet stresses the importance of dealer service and support. Prodigy Systems, 497 Lincoln Highway, Iselin, NJ, 08830, (201) 257-9530.

CIRCLE INQUIRY NO. 203

Office automation newsletter is edited for general management and contains non-technical articles about office automation, systems management and financial reporting. Complimentary subscriptions are available from Joel Gendelman, Delphi Systems, 4605 Lankershim Blvd., North Hollywood, CA 91602.

CIRCLE INQUIRY NO. 204

Dealer purchasing catalog includes a photograph of each product, detailed product descriptions, suggested retail pricing, product specifications, warranty information and dealer pricing. Some of the manufacturers represented include Atari Home Computers and Peripherals, Altos Multi-User Computers, Televideo Computers and Terminals, Anadex, Epson, Okidata and NEC Dot Matrix Printers, Diablo, NEC Qume and Alphacom Typewriter Quality Printers, NEC and Amdek Monitors, Maxell Diskettes, and software by Personal Software, Micro Pro, MicroSoft and Innovative. Microamerica Distributing, 21 Putnam St., Needham, MA 02194.

CIRCLE INQUIRY NO. 205

Book catalog features such titles as *Law and the Computer, JCL in a System 370 Environment, Assembly Language for the PDP-11, Application Design Handbook for Distributed Systems, Conversational Basic: A Dialogue Approach to Programming, EDP: Controls and Auditing.* All books are available on a 15-day examination basis. CBI Publishing Co., 51 Sleeper St., Boston, MA 02210.

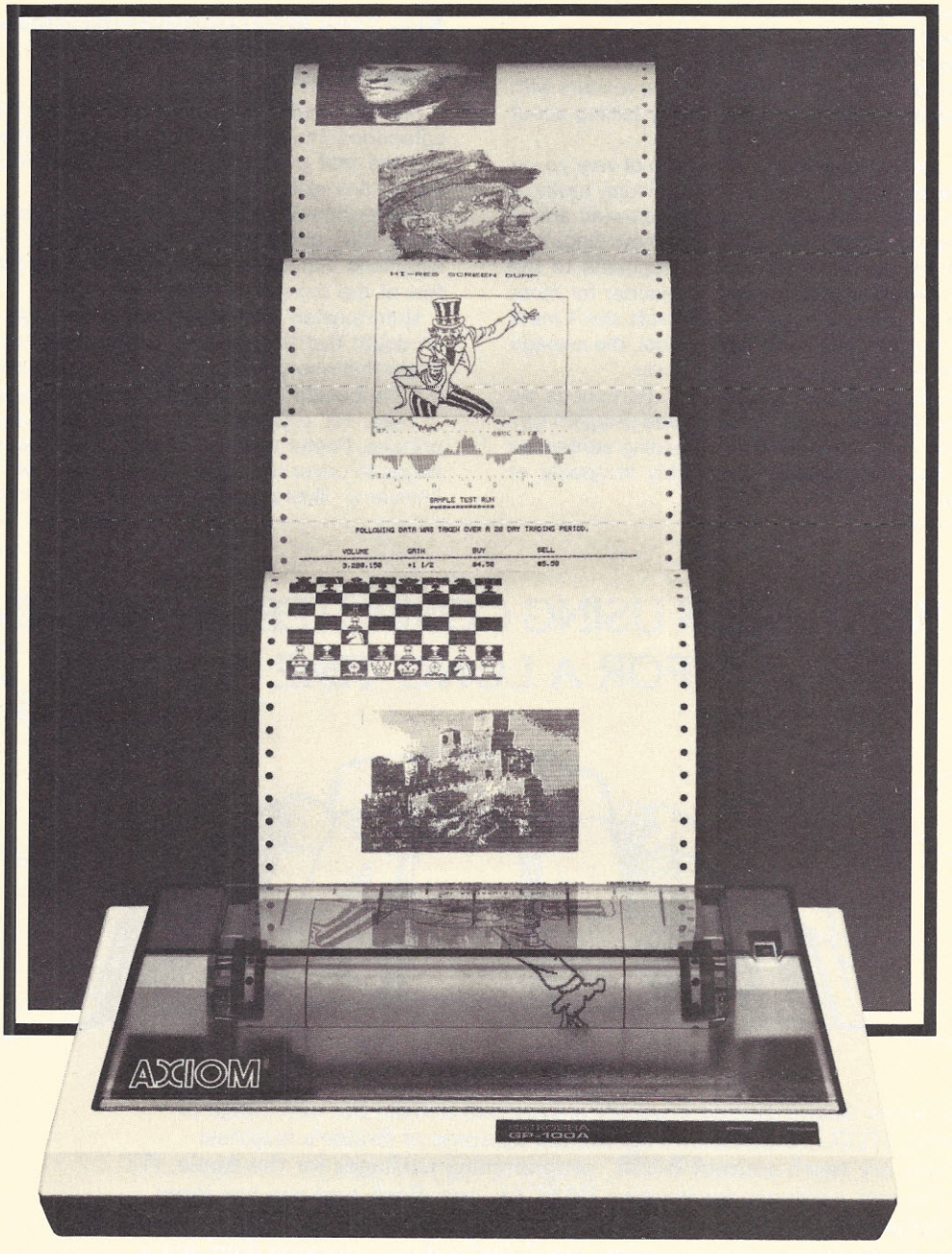
CIRCLE INQUIRY NO. 206

Photoelectric sensors are described in four-page brochure. The subminiature LED devices are designed especially for the high-volume user. Photos, product features, dimensional drawings and basic specifications are included. Skan-a-Matic, P.O. Box S or Route 5 West, Elbridge, NY 13060.

CIRCLE INQUIRY NO. 207

$389.

Made by Seikosha, AXIOM's new GP-100 is the finest printer a little money can buy. It uses standard 8-1/2 x 11 paper and has AXIOM's fabulous graphics interfaces for Apple, TRS-80, Atari, PET, HP and more! See the GP-100 at your AXIOM dealer today!



AXIOM

AXIOM CORPORATION

Seikosha is the leading company of the worldwide Seiko Group.

1014 Griswold Avenue, San Fernando, CA 91340 • Telephone: (213) 365-9521 • TWX: 910-496-1746

BOOK REVIEWS

A Young Person's Guide to Computers
by Paul M. Danzer
Scelbi Publications, Milford, CT

Reviewed by John Edwards

So you're feeling guilty about purchasing a microcomputer system, and want to justify the expense by involving your child with it. Unfortunately, little Walter shows no aptitude for computers, and your explanations of even the simplest programs fall on deaf ears. Now you're looking for a book to give the kid that will enlighten him about the wonderful world of computing. Great. Just be sure to pass this one up.

Not that the book contains any misleading information. It doesn't. Nor does the book overwhelm its young readers with too much information. Far from it. What we're talking about here is attitude.

Take the cover, for instance. It shows a group of *very* young kids, painted in the style of a pre-schooler, obviously having a grand time with a micro. The book's title is scrawled above them in a cutesy representation of a child's handwriting. Yet, at the conclusion of the book, the author suggests to the readers that they should ask their science teacher for more information about programming. Since most kids don't meet their first science teacher until junior high school, the average twelve-year-old would be offended by the cover.

There's also the little matter of writing style. Sentences are constructed in the "Dick and Jane" style: "See program run. Run, program, run." Anyone incapable of reading sentences containing more than four words is probably incapable of programming, too.

Within recent years, the market for computer books has expanded at a fantastic rate. Many elementary computer books are available that will help both young and old discover this wonderful field in a painless, logical way. There's no reason to buy a book that treats the reader like an idiot. Just because one may not be acquainted with a human endeavor is no reason to write down to him. Authors of good elementary and junior high textbooks have long realized this.

102 pages $7.95

Real Time Programming—Neglected Topics
by Caxton C. Foster
Addison-Wesley, Reading, MA

Microcomputing people seem to fall into three general categories: the experts, those who think themselves experts, and the rest of us. It's for the middle group that Caxton C. Foster has written this book.

Foster considers programming techniques that aren't used every day, but come in very handy for out-of-the-ordinary situations. Semaphores, multiplexing and interrupts are just a few of the dozens of topics covered.

Unfortunately, the book's vast scope is its undoing. There's no doubt that the subjects covered by Foster are important items that every well-versed microcomputerist should know, but the book's total lack of depth is frustrating.

Take, for example, the treatment of semaphores. In his preface, Foster admits that another author needed almost 80 pages to cover the topic. Foster, however, "covers" it in ten (including illustrations). And, frankly, it makes for pretty

skimpy reading. From topic to topic, the skimming continues: enough material to whet the appetite perhaps, but never enough to help a curious hobby computerist.

In fairness, the author explains that his book is no more than an introduction to the covered subjects. The results might have been better if Foster had cut the number of topics in half, and used his considerable powers of explanation and logic to introduce these concepts to beginners on their own level.

190 pages $10.95 —*J.E.*

Musical Applications of Microprocessors
by Hal Chamberlin
Hayden, Rochelle Park, NJ

This book could well be called a complete encyclopedia of digital electronic music theory and technique. It's hard to think of a single area the author has missed. The topics run the complete spectrum: from a thorough discussion on digital-to-analog and analog-to-digital conversion to the generation of percussive sounds. If it has to do with electronic music, it's in this book.

Personal computerists, bored with the usual fare of micro applications, should especially welcome it. A number of Basic programs are included to get the home user quickly in the swing of things. But even if actual musical composition-performance isn't a reader's main interest, the book is fascinating on a purely theoretical level. After all, getting a computer to play music is one of the more interesting applications.

Back in the days when electronic music teachers had to search the world for any sort of computer music text, this book would have been a godsend. Today it is still indispensable.

661 pages $24.95 —*J.E.*

The Year of the Robot
by Wayne Chen
Dilithium Press, Beaverton, OR

Reviewed by James C. Graves, Jr.

This is actually two books in one. Part I, "The Intellectual Robot" identifies the characteristics and principles that govern the robot. In addition, a philosophical view of the robot discusses how the robotic qualities apply to humans. This section is similar to a text book. Part II, "Robotosyncrasies" is a novel. Human characters are used to reinforce the robotic traits presented in the first half of the book.

The first part paints a philosophical picture of robotosyncrasies as human traits. Then the author spells out the social and political overtones. Finally, Part I ends with the ten robotic commandments. Four examples of these commandments state: be reflective, be broadminded, be even-tempered and fair, and allow some overshoots.

The novel portion was previously published in 1976. The protagonist of the story, a scientist, is credited with the invention H.I.M.—Human Intelligence Model—the robot. He runs a corporation that is deeply involved with this country's space effort. Other characters portray the philosophical qualities the author introduced as robotosyncrasies. As an example, the character Rap develops a revolutionary attitude toward society. In robotic terms, Rap's attitude could be contributed to the failure in the feedback feature.

The book is entertaining and enlightening. It conveys a basic overview of how the robot works, and explains how society works in robotic terms.

182 pages $7.95

Articles Wanted...

INTERFACE AGE is seeking articles on business micros in the lower price range for the August issue. Systems in the under $10,000 arena will be covered. Product reviews, compatible software and language offerings, and unique applications are all topics of interest. Articles intended for this issue should be received no later than April 1 for consideration.

Other topics being solicited during 1982 include: medical and educational applications, word processing, peripherals and interfacing products, home applications, tutorials and utility programs. Special emphasis is placed on business systems and applications.

Program listings should be no more than 60 characters wide, with no wrap-around lines. Unlined paper and a new ribbon should be used. Sample runs should also be included. In the article text, variables should be described. The system utilized in composing the program should be detailed — operating systems, language type and version, and any necessary peripherals.

The payment rate ranges from $35-80 per published page. Submissions should include an abstract and outline.

Manuscripts should be typed or printed out double-spaced with one-inch margins. Minimum length is four pages, unless programs are included. Photos should be numbered and have a brief description attached to each. Tables, listings, etc. should be on separate pages and each should have a caption. Authors are requested to submit a statement of their background and expertise.

The publisher assumes no responsibility for artwork, photos or manuscripts. No acknowledgement is made unless the submission is accompanied by a large stamped return envelope. A minimum of six weeks should be allowed for response; it is requested that authors do not phone for information about submissions.

The submissions should be addressed to: Editorial Dept., Interface Age, 16704 Marquardt Ave., Cerritos, CA 90701.

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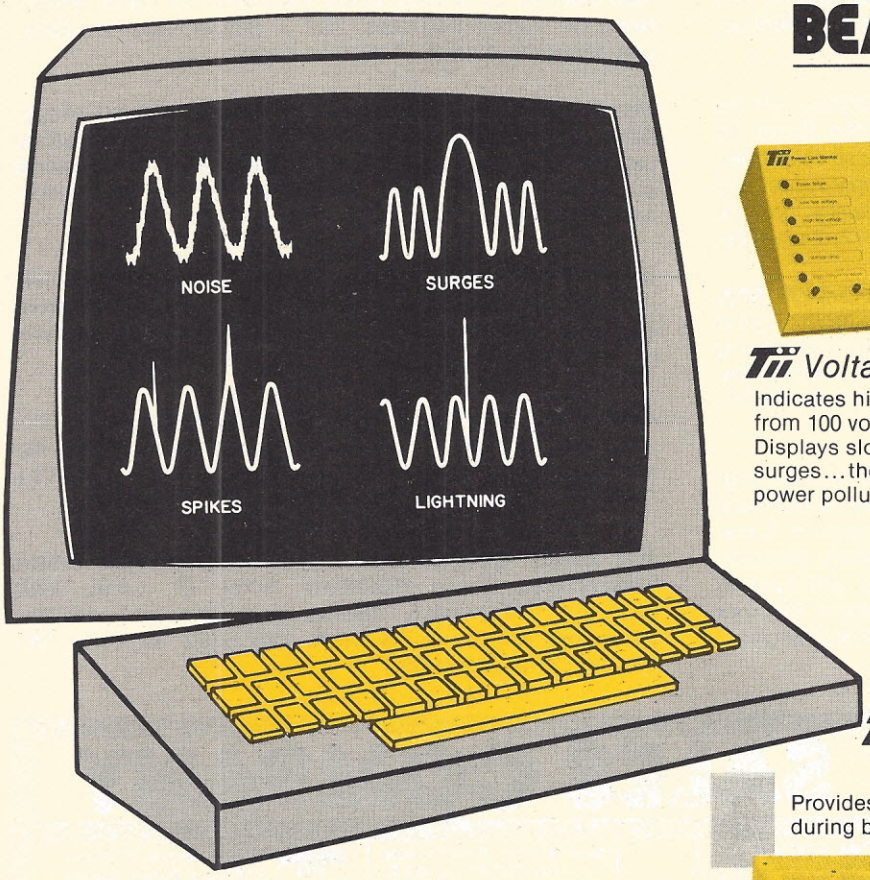

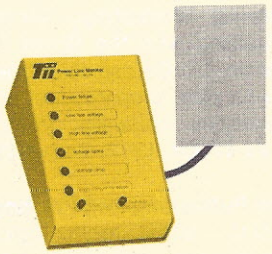

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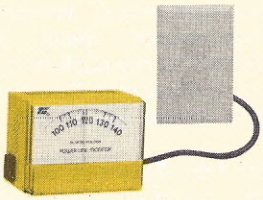

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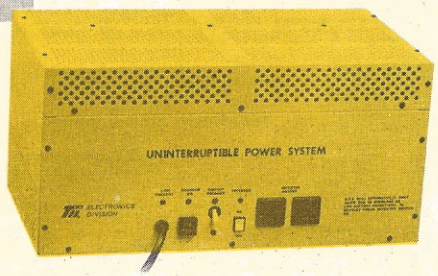

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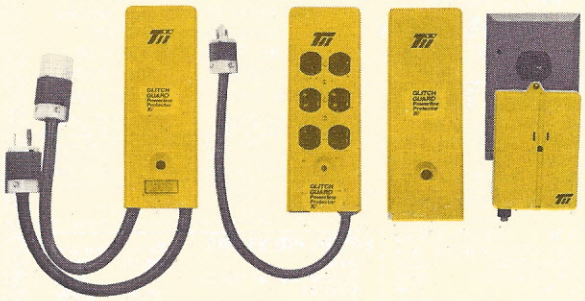

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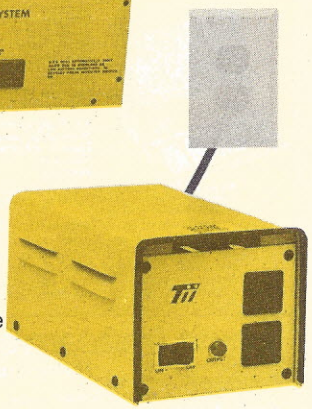

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CALENDAR

Mar 1-2 Michigan Assoc. for Computer Users in Learning Convention, Western Michigan University, Kalamazoo, MI, presentations on various facets of educational uses of computers in addition to vendor presentations and displays. Oakland Schools, 2100 Pontiac Lake Rd., Pontiac, MI 48054, (313) 858-1898.

Mar 1-3 Advanced Programming Workshop, Wintek Corp., Lafayette, IN, Hands-on training with the Sprint 68 development system and control computer. Course objectives include developing skills requires to plan, prepare, test and document microprocessor applications software. Wintek Corp., 1801 South St., Lafayette, IN 47904, (317) 742-8428.

Mar 1-3 National Conference on Publishing and Printing, Shoreham Hotel, Washington, D.C., latest technological developments, trends in management decision-making methods for the publishing, printing and information industries. U.S. Professional Development Institute, 12611 Davan Dr., Silver Spring, MD 20904, (301) 622-0066.

Mar 1-5 Electrex '82, National Exhibition Center, Birmingham, England, showcasing all types of electotechnical equipment for power production and transformation, transmission and distribution, power application, safety controls, components, electrical engineering materials and spares, instrumentation, control and automation equipment. Electrex Ltd., Wix Hill House, West Horsley, Surrey KT24 6DZ England, telephone 0483-222888.

Mar 3 California Computer Show, Marriott Hotel, Anaheim, CA, displays of equipment for OEMs, sophisticated end users, dealers and distributors featuring over 60 manufacturers. Also held Apr 22 at Hyatt Hotel, Palo Alto, CA. Carol Reimer, Norm De Nardi Enterprises, 289 S. San Antonio Rd. #204, Los Altos, CA 94022, (415) 941-8440.

Mar 6 Delaware Computer Faire, Delaware State College, Dover, DE, demonstrations for K-12 teachers, administrators, parents and interested public in classroom and personal computers. Georgia Cressman, Computer Faire, 51 S. Lockwood Rd., Elkton, MD 21921.

Mar 16-18 Software/Expo-West, Convention Center, Anaheim, CA, dealing with a wide range of applications from accounts payable to utilities. Terry Brooks, 222 W. Adams St., Suite 400, Chicago, IL 60606, (312) 263-3131.

Mar 24-26 EDP Quality Assurance Symposium, McCormick Inn, Chicago, IL, stressing solutions to EDP quality problems. U.S. Professional Development Institute, 12611 Davan Dr., Silver Spring, MD 20904, (301) 622-0066.

Mar 27-28 Computer Hobbyists and Amateur Radio Convention, Chase Park-Plaza Hotel, St. Louis, MO, including flea market, national exhibitors and dealers, workshops and forums. G.A.R.A., Box 8432, St. Louis, MO 63132, (314) 361-4965.

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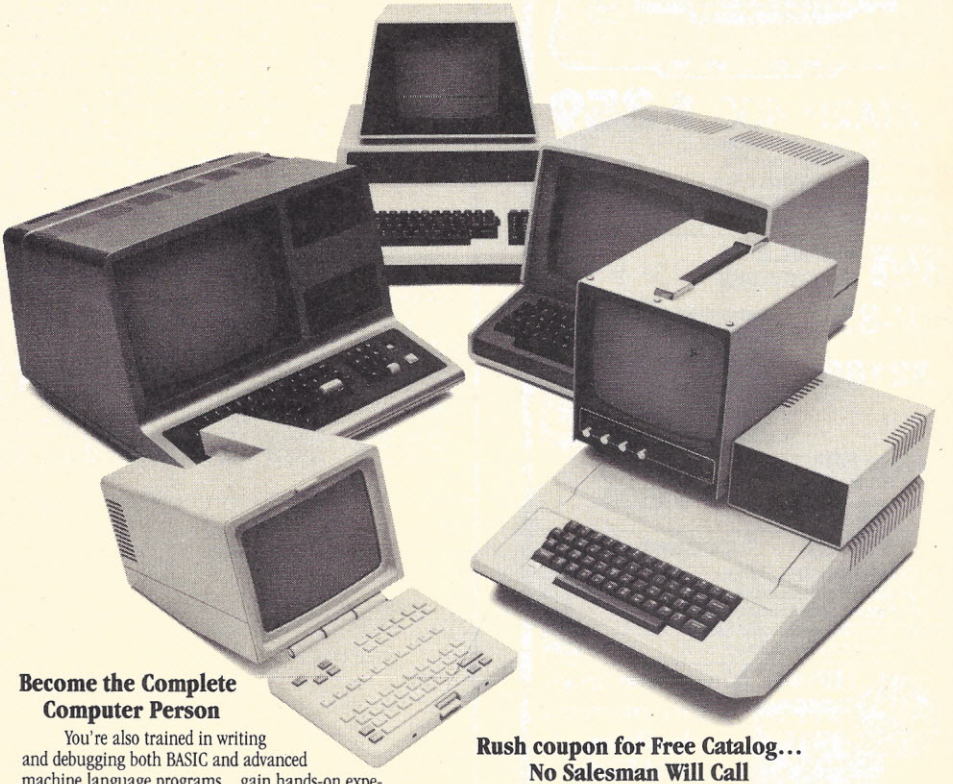

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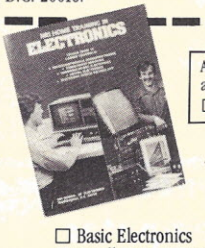

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Game Corner

Continued from page 27

Listing 1

```
5 ' ANOTHER VERSION OF THE ZEBRA PROBLEM
10 DIM A$(4,4):DIM B$(4,4):DEFINT C:CLEAR 2000
20 DATA "Norwegian", "Yellow", "Kools", "Water", "Fox"
30 DATA "Ukranian", "Blue", "Chesterfields", "Tea", "Horse"
40 DATA "Englishman", "Red", "Old Golds", "Milk", "Snails"
50 DATA "Spaniard", "Ivory", "Luckies", "Orange J.", "Dog"
60 DATA "Japanese", "Green", "Parliament", "Coffee", "Zebra"
90 'RLAD IN A$ ARRAY
100 FOR J=0 TO 4
110 FOR I=0 TO 4
120 RLAD A$(I,J)
130 B$(I,J)=A$(I,J)
140 NLXT I,J

2990 'PERMUTATION ARRAY OF 0,1,2,3,4s
3000 DIM COL(120,4)
3001 DATA 0,1,2,3,4,0,2,1,3,4,0,2,3,1,4,0,2,3,4,1
3002 DATA 0,1,2,4,3,0,2,1,4,3,0,2,4,1,3,0,2,4,3,1
3003 DATA 0,1,3,2,4,0,3,1,2,4,0,3,2,1,4,0,3,2,4,1
3004 DATA 0,1,3,4,2,0,3,1,4,2,0,3,4,1,2,0,3,4,2,1
3005 DATA 0,1,4,2,3,0,4,1,2,3,0,4,2,1,3,0,4,2,3,1
3006 DATA 0,1,4,3,2,0,4,1,3,2,0,4,3,1,2,0,4,3,2,1
3007 DATA 1,0,2,3,4,1,2,0,3,4,1,2,3,0,4,1,2,3,4,0
3008 DATA 1,0,2,4,3,1,2,0,4,3,1,2,4,0,3,1,2,4,3,0
3009 DATA 1,0,3,2,4,1,3,0,2,4,1,3,2,0,4,1,3,2,4,0
3010 DATA 1,0,3,4,2,1,3,0,4,2,1,3,4,0,2,1,3,4,2,0
3011 DATA 1,0,4,2,3,1,4,0,2,3,1,4,2,0,3,1,4,2,3,0
3012 DATA 1,0,4,3,2,1,4,0,3,2,1,4,3,0,2,1,4,3,2,0
3013 DATA 2,0,1,3,4,2,1,0,3,4,2,1,3,0,4,2,1,3,4,0
3014 DATA 2,0,1,4,3,2,1,0,4,3,2,1,4,0,3,2,1,4,3,0
3015 DATA 2,0,3,1,4,2,3,0,1,4,2,3,1,0,4,2,3,1,4,0
3016 DATA 2,0,3,4,1,2,3,0,4,1,2,3,4,0,1,2,3,4,1,0
3017 DATA 2,0,4,1,3,2,4,0,1,3,2,4,1,0,3,2,4,1,3,0
3018 DATA 2,0,4,3,1,2,4,0,3,1,2,4,3,0,1,2,4,3,1,0
3019 DATA 3,0,1,2,4,3,1,0,2,4,3,1,2,0,4,3,1,2,4,0
3020 DATA 3,0,1,4,2,3,1,0,4,2,3,1,4,0,2,3,1,4,2,0
3021 DATA 3,0,2,1,4,3,2,0,1,4,3,2,1,0,4,3,2,1,4,0
3022 DATA 3,0,2,4,1,3,2,0,4,1,3,2,4,0,1,3,2,4,1,0
3023 DATA 3,0,4,1,2,3,4,0,1,2,3,4,1,0,2,3,4,1,2,0
3024 DATA 3,0,4,2,1,3,4,0,2,1,3,4,2,0,1,3,4,2,1,0
3025 DATA 4,0,1,2,3,4,1,0,2,3,4,1,2,0,3,4,1,2,3,0
3026 DATA 4,0,1,3,2,4,1,0,3,2,4,1,3,0,2,4,1,3,2,0
3027 DATA 4,0,2,1,3,4,2,0,1,3,4,2,1,0,3,4,2,1,3,0
3028 DATA 4,0,2,3,1,4,2,0,3,1,4,2,3,0,1,4,2,3,1,0
3029 DATA 4,0,3,1,2,4,3,0,1,2,4,3,1,0,2,4,3,1,2,0
3030 DATA 4,0,3,2,1,4,3,0,2,1,4,3,2,0,1,4,3,2,1,0
```

```
5000 FOR I=0 TO 119
5010 FOR J=0 TO 4
5020 READ COL(I,J)
5030 NEXT J,I
9990 'NESTED LOOPS TO DO TESTING
1000 ' DEFINE SUBSCRIPT ARRAY
1010 DEFINT C
1020 DIM COL(5,4)
1030 DATA 0,1,2,3,4,0,1,2,4,3,0,1,3,2,
4,0,1,3,4,2,0,1,4,2,3,0,1,4,3,2
1040 FOR I=0 TO 5
1050 FOR J=0 TO 4
1060 READ COL(I,J)
1070 NEXT J,I
1080 GOSUB 1290 :'PRINTOUT INITIAL ARRAY
1090 FOR N=0 TO 4
1100 FOR L=1 TO 3
1110 M=L+1:IF M=5 THEN M=1
1120 FOR K=0 TO 5
1130 C=COL(K,L):COL(K,L)=COL(K,M):COL(K,M)=C
1140 NEXT K
1150 GOSUB 1290 :'DO EVERYTHING ELSE
1160 NEXT L
1170 FOR I=0 TO 5
1180 C=COL(I,4):COL(I,4)=COL(I,3):COL(I,3)=COL(I,2):
COL(I,2)=COL(I,1):COL(I,1)=C
1190 NEXT I
1200 'ROTATE COLUMNS 1,2,3,4 AS 4,1,2,3
1210 FOR I=0 TO 5
1220 FOR J=0 TO 4
1230 IF COL(I,J)=N THEN COL(I,J)=N+1 ELSE IF COL(I,J)=N+1 THEN
COL(I,J)=N
1240 IF N+1=5 THEN END
1250 NEXT J,I
1255 INPUT V$
1260 GOSUB 1290 :'PRINTOUT FIRST ARRAY OF NEW SEQUENCE
1270 NEXT N
1280 END
1290 FOR P=0 TO 5
1300 FOR Q=0 TO 4
1310 LPRINT COL(P,Q);
1320 NEXT Q
1330 LPRINT
1340 NEXT P
1350 LPRINT
1360 RETURN
```

Listing 2

```
10000 FOR B0=0 TO 23
10010 I=0
10020 I=B0
10030 GOSUB 20000
```

```
10040    FOR B1=0 TO 119
10050    I=1
10060    H=B1
10070    GOSUB 20000
10080      FOR B2=0 TO 119
10090      I=2
10100      H=B2
10110      GOSUB 20000
10120        FOR B3=0 TO 119
10130        I=3
10140        H=B3
10150        GOSUB 20000
10160          FOR B4=0 TO 119
10170          I=4
10180          H=B4
10190          GOSUB 20000
10200          GOSUB 30000
10210          NEXT B4
10220        NEXT B3
10230      NEXT B2
10240    NEXT B1
10250 NEXT B0
19990 'SHUFFLE ROUTINE TO PERMUTE A$ INTO B$
20000 FOR J=0 TO 4
20010 B$(I,J)=A$(I,COL(H,J))
20020 NEXT J
20030 RETURN
29990 'TEST ROUTINE TO CHECK 14 CONDITIONS
30000 PASS = 0
30010 FOR NN=0 TO 4
30020 IF B$(0,NN)="Englishman" AND B$(1,NN)="Red" THEN
PASS=PASS+1
30030 IF B$(0,NN)="Spaniard" AND B$(4,NN)="Dog" THEN
PASS=PASS+1
30040 IF B$(3,NN)="Coffee" AND B$(1,NN)="Green" THEN
PASS=PASS+1
30050 IF B$(0,NN)="Ukranian" AND B$(3,NN)="Tea" THEN
PASS=PASS+1
30060 IF NN+1<5 THEN IF B$(1,NN+1)="Green" AND
B$(1,NN)="Ivory" THEN PASS=PASS+1
30070 IF B$(2,NN)="Old Golds" AND B$(4,NN)="Snails" THEN
PASS=PASS+1
30080 IF B$(2,NN)="Kools" AND B$(1,NN)="Yellow" THEN
PASS=PASS+1
30090 IF B$(3,NN)="Milk" AND NN=2 THEN PASS=PASS+1
30100 IF B$(0,NN)="Norwegian" AND NN=0 THEN PASS=PASS+1
30110 IF NN>0 THEN IF B$(2,NN)="Chesterfields" AND B$(4,NN-1)
="Fox" THEN PASS=PASS+1

30115 IF NN<4 THEN IF B$(2,NN)="Chesterfields" AND B$(4,NN+1)
="Fox" THEN PASS=PASS+1
30120 IF NN>0 THEN IF B$(2,NN)="Kools" AND B$(4,NN-1) ="Horse"
THEN PASS=PASS+1
30125 IF NN<4 THEN IF B$(2,NN)="Kools" AND B$(4,NN+1) ="Horse"
THEN PASS=PASS+1
30130 IF B$(2,NN)="Luckies" AND B$(3,NN)="Orange J." THEN
PASS=PASS+1
30140 IF B$(0,NN)="Japanese" AND B$(2,NN)="Parliament" THEN
PASS=PASS+1
30150 IF B$(1,NN)= "Blue" AND NN=1 THEN PASS=PASS+1
30160 NEXT NN
30170 IF PASS = 14 THEN GOSUB 31000
30180 RETURN
30990 'PRINTOUT ROUTINE FOR ARRAYS THAT PASS THE TESTS
31000 FOR P=0 TO 4
31010 FOR Q=0 TO 4
31020 LPRINT B$(P,Q),
31030 NEXT Q
31040 LPRINT
31050 NEXT P
31060 LPRINT
31070 RETURN
```

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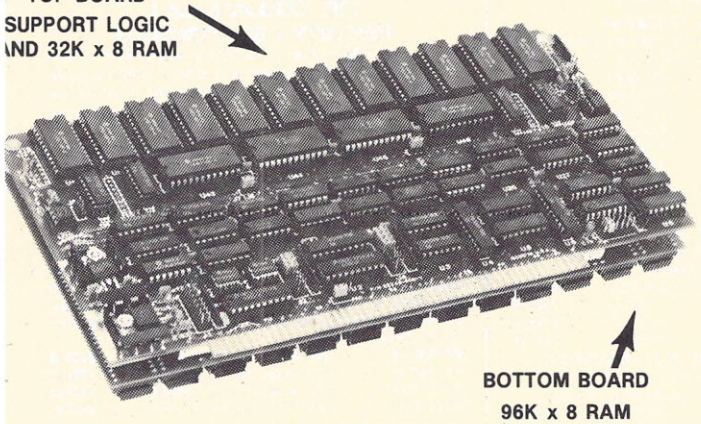
SUPPORT LOGIC
AND 32K x 8 RAM



BOTTOM BOARD
96K x 8 RAM

128K x 8/64K x 16 organization
2K x 8 150nsec. Max. RAM devices (70, 90 or 120 nsec, optional)
Pin compatible with Intel 2716 type EPROMS
Dynamic 16 or 8 bit configuration selection
24 bit extended address or 16 bit S-100 Std.
Physical board address on 16K/8K boundaries
Memory Management functions. (Software or hardware selectable)
- Bank select / deselect
- Bank write protect
- Bank readdress

} 32K / 16K Banks

- Phantom select/override
- Wait cycle select/deselect

- I/O Port selection independent of Memory address (2 out of 256)
- MWRITE & PHANTOM logic selection
- Error signal on write attempts into write protected areas
- Battery back-up capability
- Low input power requirements: 600Ma. Max. active 8VDC in. 30Ma. Avg. battery back-up
- Modular construction — Module can be easily and quickly disassembled for maintenance (no solder connections between boards)
- Single Bus Connector Interface
- Dimensions — 5.125″H x 10.0″W x 1.25″D
- Weight — 1.5 lbs.
- Comprehensive Users Manual
- On-board Test circuit
- Plus more...

PART 52748-650-128 (Assembled and Tested)
Inquire about other versions

Please ship _____ Megaram Boards as described above @ $1024.00 each. **Offer expires April 30, 1982.

☐ CHECK ☐ VISA OR MASTERCARD

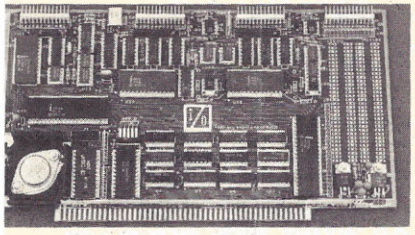
CARD # _____ EXP. _____

NAME _____

STREET _____

CITY, STATE, ZIP _____

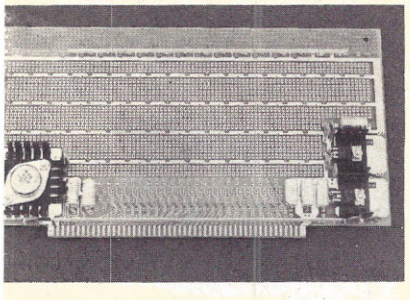
JLTI-FUNCTION I/O BOARD



The multiple on-board functions allow for complete software and hardware I/O task(s) control. **Features:** Two independent SYNC/ASYNC serial ports (Software programmable with status read interface: RS-232-C or current loop — 20 or 60ma — or TTL with handshaking. Dedicated output connectors for each port) ■One strobed 8-bit parallel port with handshaking (Software status read) ■Three 8-bit parallel ports undedicated & user configured (Software programmable for input, output, plus input/output/bidirectional with handshaking or combinations thereof. Software status read for handshake logic) ■Three independent 16-bit timers (software programmable for 5 operating modes. Indiv. clock source input & gate control — int. or ext. Uninterrupted read. Two buffered outputs) ■Eight level priority interrupt controller (Software programmable highest interrupt level. 8080/Z80 auto restart command) ■Two software programmable baud rate generators with crystal controlled frequencies ± .01% ■Large prototyping area with access to regulated +5, +12, — 12VDC.

ssembled and Tested — P/N 52748-100-101 — $325, Kit P/N 52748-100 — $225, Bare Board P/N 52748-1XX — $85

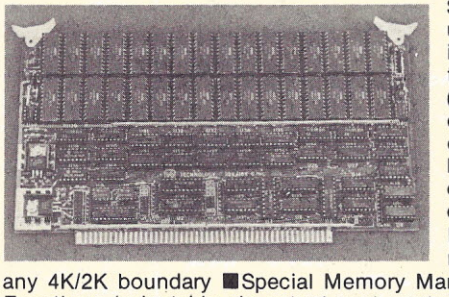
PROTOTYPING BOARD



Provides flexibility and saves hours of power busing layout time.
Features: Bus-bar power distribution ■Allows wire-wrap or soldering of sockets and discrete components ■Accepts all std. sockets on .30″ & .60″ centers ■3 regulators (+5V ±12V) with filter and decoupling capacitors ■Accepts edge connectors or components on .10″ centers.

includes: 3 regulators w/3 heat-sinks/filter capacitors/2 bus bars and
.nual **P/N 52748-400** **$49.95**

STATIC RAM BOARD



The **32K x 8/16K x 16** STATIC RAM BOARD uses low power and its fast device access time of 200 nsec (max.) allows for operation @4MHz without any wait cycles. **Features:** IEEE-696 compatibility with extended addressing ■Memory address may start and stop on any 4K/2K boundary ■Special Memory Management and Control Functions (selectable via output port control word(s): Bank select/deselect 8K/4K, Bank write protect 8K/4K, Bank readdress 8K/4K ■Software page select/override ■Software wait cycle select (if slower devices utilized by user) ■External power source back-up capability for Memory Array ■Low input power requirements (full memory array - 150 MA max. @8VDC IN — support logic-500 ma typ @8VDC IN) ■Socketed RAMs and support logic IC's for easy maintenance ■Comprehensive Manual.
Assembled and Tested — P/N 52748-500-100 $485, Bare Board P/N 52748-5XX $95.

sterCard. VISA

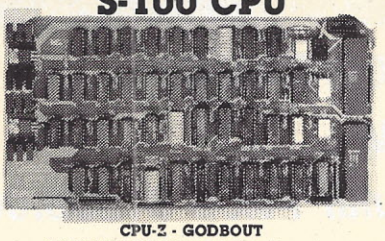
CA residents add 6% tax
S. Domestic Price, FOB Factory

I/O TECHNOLOGY

POST OFFICE BOX 2119
CANYON COUNTRY, CA 91351
CIRCLE INQUIRY NO. 114 (805) 252-7666

PRIORITY ONE ELECTRONICS

S-100 CPU



CPU-Z - GODBOUT
2/4 MHZ Z80 CPU 24 Bit Addressing

ICGBT 160A	A & T	$199.00
ICGBT 160C	CSC 3-6 MHZ	$375.00

DUAL PROCESSOR 8085-8088 - GODBOUT
6 or 8 MHZ Provides true 16 Bit Power with a standard 8 bit S-100 bus.

ICGBT 1612A	A & T	6 MHZ	$399.00
ICGBT 1612C	CSC	8 MHZ	$498.00

SOLID STATE DISK DRIVE, 3500% FASTER!
Not Really, But the Next Best Thing For Godbout 8085/88 Users. Call for Details on M-Drive. See Page 340 of November **BYTE**

ICGBT MD 128K		$1,550.00
ICGBT MD 256K		$3,000.00

2810 Z80 CPU-CA. COMP. SYST.
2/4 MHZ Z80A CPU with RS232C Serial I/O Port complete with Monitor PROM for 2422 Disk Controller

ICCCS 2810A	A & T	$280.00

CB2 Z80 CPU - S.S.M.
2/4 MHZ will accept 2716, or 2732, or RAM RUN/STOP and single step switches

ICSSMCB2K	Kit	$260.00
ICSSMCB2A	A & T	$310.00
ICSSMZ80M	SSMZ80 Monitor	$89.00

CBIA 8080 CPU - S.S.M.
8080 CPU, 1K RAM, Holds 1 2708, 1 Bit parallel input port.

ICSSMCB1K	Kit	$183.00
ICSSMCB1A	A & T	$225.00
ICSSM8080M	SM 8080 Monitor	$59.00

S-100 I/O BOARDS

SYSTEM SUPPORT 1 - GODBOUT
Serial port (software prog baud), 4K EPROM OR RAM provision, 15 levels of interrupt, real time clock, optional math processor

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
ICGBT162A	Assembled & Tested	$399.00	$360.00
ICGBT162C	CSC	$495.00	$460.00
ICGBT8231	Math Chip		$195.00
ICGBT8232	Math Chip		$195.00
ICGBT162AM1	A&T with 8231 Math Chip		$555.00
ICGBT162CM1	CSC with 8231 Math Chip		$655.00
ICGBT162AM2	A&T with 8232 math Chip		$555.00
ICGBT162CM2	CSC with 8232 Math Chip		$655.00

MPX CHANNEL BOARD - GODBOUT
I/O Multiplexer. using 8085A-2 CPU on board

ICGBT166A	A & T	$495.00	$450.00
ICGBT166C	CSC	$595.00	$550.00

INTERFACER I - GODBOUT
Two Serial I/O

ICGBT133A	A & T	$249.00	$219.00
ICGBT133C	CSC	$324.00	$298.00

INTERFACER II - GODBOUT
Three parallel, one serial I/O board

ICGBT150A	A & T	$249.00	$219.00
ICGBT150C	CSC	$324.00	$289.00

INTERFACER III - GODBOUT
Eight channel multi-use serial I/O board

ICGBT1748A	A & T	$699.00	$629.00
ICGBT1748C	CSC 200 hr. Burn In	$849.00	$629.00

INTERFACER 3 WITH 5 SERIAL PORTS

ICGBT1745A	A & T	$599.00	$559.00
ICGBT1745C	CSC 200 hr. Burn In	$699.00	$629.00

MULTI I/O - MORROW DESIGNS
Three Serial, Two parallel

ICMDSMB3200	A & T	$359.00	$329.00

SWITCHBOARD - MORROW DESIGNS
Two serial I/O, four parallel I/O, one status port, one strobe port

ICMDSSB2411		$299.00	$269.00

I/O4 - SSM
Two serial I/O, two parallel I/O

ICSSMI04K	Kit		$210.00
ICSSMI04A	A & T	$290.00	$260.00

I/O 5 - SSM
2 Serial, 3 Parallel including 1 Centronics

ICSSMI051	A & T	$329.00	$309.00

I/O 8 - SSM
8 Port Serial I/O with Timer

ICSSMI08A	A & T	$550.00	$495.00

2710 4 PORT SERIAL - CCS
4 Full handshaking RS232 ports and optional 2K ROM

ICCCS271001	A & T	$360.00	$310.00

2718 2 SERIAL & 2 PARALLEL - CCS
2 RS232 C ports, 2 8 bit parallel ports, & optional 2K ROM

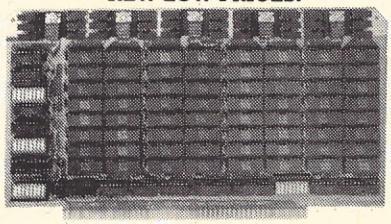
ICCCS271801	A & T	$360.00	$325.00

2720 4 PORT PARALLEL - CCS
4 8 bit parallel ports and optional 2K ROM

ICCCS272001	A & T	$250.00	$225.00

S-100 10 MHZ STATIC RAM

NEW LOW PRICES!



32K STATIC RAM - GODBOUT
RAM 20 10 MHZ, 4K byte block disable, bank select or 24 bit addressing available 8, 16, 24 or 32K

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
ICGBT164AA8	8K A&T	$210.00	$190.00
ICGBT164AC8	8K CSC	$280.00	$260.00
ICGBT164AA16	16K A&T	$285.00	$260.00
ICGBT164AC16	16K CSC	$355.00	$325.00
ICGBT164AA24	24K A&T	$355.00	$325.00
ICGBT164AC24	24K CSC	$425.00	$385.00
ICGBT164AA32	32K A&T	$425.00	$385.00
ICGBT164AC32	32K CSC	$495.00	$450.00

64K STATIC RAM - GODBOUT
RAM 17, 10 MHZ, 2 Watt, DMA Compatable 24 Bit Addressing

ICGBT175A48	48K A&T	$650.00	$619.00
ICGBT175C48	48K CSC 200hr.	$750.00	$710.00
ICGBT175A64	64K A&T	$795.00	$755.00
ICGBT175C64	64K CSC 200hr.	$895.00	$850.00

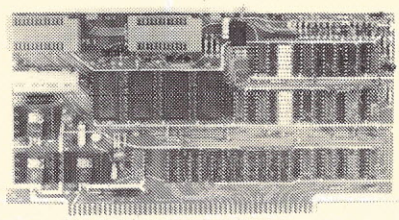
NEW! 32K x 16 BIT STATIC RAM - GODBOUT
RAM 16 10 MHZ, 32K x 16 or 64K x 8 IEEE/696 16 BIT 2 Watt, 24 Bit Addressing

ICGBT180A	64K A&T	$895.00	$850.00
ICGBT180C	64K CSC	$995.00	$945.00

NEW! 128K STATIC RAM - GODBOUT
RAM 21 10MHZ 128K X 8 OR 64K x 16 IEEE/696 8 or 16 Bit 1.2 Amps 24 Bit Addressing

ICGBT167A	128K A&T	$1695.00	$1610.00
ICGBT167C	128K CSC	$1895.00	$1795.00

S-100 ROM



PBI PROM PROGRAMMER - SSM
Programs 2708 or 2716's, operates as a 4K/8K EPROM BOARD AS WELL.

ICSSMPB1K	Kit		$179.00
ICSSMPB1A	A & T	$265.00	$220.00

ECONOROM 2708 - GODBOUT
16K x 8 EPROM Board using 2708, Power on jump to any 256 byte

ICGBT125A	A & T	$135.00	$120.00
ICGBT125C	CSC	$195.00	$175.00

MB8A - SSM
1K/16K 2708 EPROM board, disable in 1K increments

ICSSMMB8AK	Kit		$114.00
ICSSMMB8AA	A & T	$179.00	$159.00

S-100 VIDEO BOARDS

SPECTRUM - GODBOUT
Color Graphics board with Parallel I/O

ICGBT144A	A & T	$399.00	$349.00
ICGBT144C	CSC	$449.00	$399.00
ICGBT2D	Sublogic Universal Graphics Interpreter Software		$35.00

VB - 3 S.S.M.
80 x 25 or 50 character video display Memory Mapped, Parallel Keyboard port

ICSSMVB3K24	80 x 24 Kit		$425.00
ICSSMVB3A24	80 x 24 A&T	$499.00	$440.00
ICSSMVB3UP	80 x 50 Line Upgrade		$ 39.00

VB2-S.S.M.
I/O Mapped Video Board, with Parallel Keyboard port 64 x 16

ICSSMVB2K	Kit		$199.00
ICSSMVB2A	A & T	$269.00	$229.00

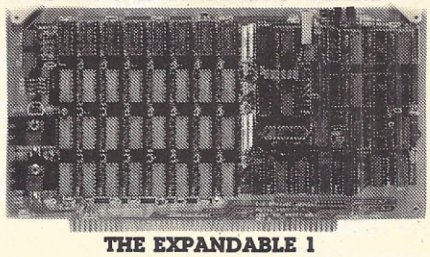
VBIC - S.S.M
Memory Mapped Video Board 64 x 16 character display or 64 x 16 graphics display

ICSSMVB1K	Kit		$179.00
ICSSMVB1A	A & T	$242.00	$220.00

S-100 MOTHERBOARDS - GODBOUT
Active termination, 6-12-20 slot

ICGBT153A	A&T 6 slot, 2 lbs	$140.00	$126.00
ICGBT153C	CSC 6 slot, 2 lbs.	$190.00	$175.00
ICGBT154A	A&T 12 slot, 3 lbs.	$175.00	$155.00
ICGBT154C	CSC 12 slot, 3 lbs.	$240.00	$220.00
ICGBT155A	A&T 20 slot, 4 lbs.	$265.00	$235.00
ICGBT155C	CSC 20 slot, 4 lbs.	$340.00	$310.00

S-100 DYNAMIC RAM

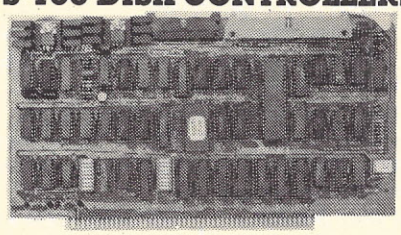


THE EXPANDABLE 1
PRIORITY 1 ELECTRONICS

THE EXPANDABLE 1™ 64K Dynamic Ram board provides your S-100 system with 64K of reliable, high-speed dynamic RAM. Compatable with most of the major S-100 systems on the market, including those with front panels, it supports DMA operations and requires no Wait states with current microprocessors.
● User expandable from 16 to 64K ● Supports DMA ● Designed to IEEE proposed S-100 bus standards ● 2 or 4 MHz operation ● Operates with either an 8080 or Z-80 based S-100 system, providing processor-transparent refreshes with both ● Supports IMSAI-type front panels ● Jumper-selectable Phantom input ● Uses Popular 4116 RAMS ● All ICs in sockets ● Any 16K block can be made bank-independent ● Fully buffered address and data lines ● Fail-safe refresh circuitry for extended Wait states ● Board configuration with reliable, easy-to-configure Berg jumpers

ICPRIEXP116	16K Assembled & Tested	$299.00
ICPRIEXP132	32K Assembled & Tested	$339.00
ICPRIEXP148	48K Assembled & Tested	$379.00
ICPRIEXP164	64K Assembled & Tested	$409.00

S-100 DISK CONTROLLERS



DISK 1 - GODBOUT
FAST DMA, Soft Sector, Controls 8" or 5¼", single or double density OUR BEST!

		LIST PRICE	OUR PRICE
ICGBT171A	A & T	$495.00	$450.00
ICGBT171C	CSC	$595.00	$555.00
ICGBTCPM80*	CP/M 2.2 for Z80/8085 with manuals & BIOS 8" S/D disk		$175.00
ICGBTOAS8S	Oasis 8 bit single user 8" S/D disk		$500.00
ICGBTOAS8M	Oasis 8 bit multiuser, 8" S/D disk		$850.00

2422A - CA. COMP. SYST.
I/O Mapped, controls 8", single or double density A&T with CPM 2.2 8" S.D.

ICCCS2422A		$475.00	$375.00

DISK JOCKEY 2D - MORROW
Memory Mapped, controls 8", single or double density, serial I/O

ICMDSDJ2208	A&T with CP/M 2.2	$399.00	$375.00

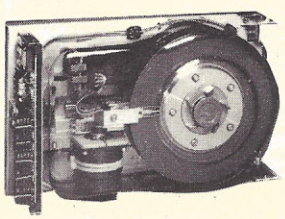
S-100 DISK SUBSYSTEMS

DISCUS SINGLE SIDED MORROW
8" DBL Density drives with cabinet, power supply controller, with CP/M 2.2 and Microsoft Basic

ICMDSF1218	Single Drive System	$1095.00	$950.00
ICMDSF1228	Dual Drive System	$1875.00	$1598.00

DISCUS DOUBLE SIDED - MORROW
8" DBL Density/sided drives with cabinet Power supply controller, with CP/M 2.2 and Microsoft Basic

ICMDSF2218	Single Drive System	$1395.00	$1250.00
ICMDSF2228	Dual Drive System	$2495.00	$2050.00



S-100 HARD DISK - MORROW

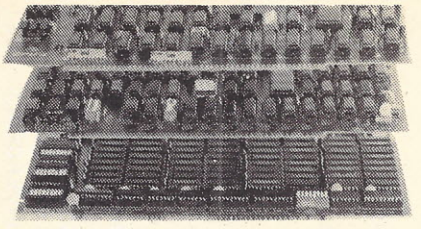
5.25" 5MB, 8" 10 & 20MB, 14" 26MB formatted hard disk complete with cabinet, P.S., Controller, CP/M 2.2 and Microsoft MBASIC 80

		LIST PRICE	SALE PRICE
ICMDSDMAM5	5 MB	$2495.00	$2250.00
ICMDSM10S	10 MB	$3695.00	$2950.00
ICMDSM20S	20 MB	$4795.00	$3825.00
ICMDSM26S	26 MB	$4495.00	$3495.00

PRIORITY ONE ELECTRONICS

CIRCLE INQUIRY NO. 99

S-100 SYSTEMS



"LITTLE 8" Z80 SYSTEM STARTER SET
GODBOUT

CPU Z: *A 4MHz Z80 A-based 8-bit workhorse CPU board that includes all the standard features plus many of the convenience options. Meets all IEEE 696/S-100 specifications, including timing.*

DISK 1 DMA High Performance Disk Controller: *disk controlers don't have to be your system's bottleneck! The DISK 1 is lightning fast thanks to properly implemented DMA (with arbitration) and transfer that is independent of CPU speed.*

RAM 20 32K High Speed Static RAM. *This board has it all! Operates at speeds up to 10MHz, ultra-low power consumption, IEEE 696/S-100 extended addressing protocol, bank select and flawless DMA.*

CP/M 2.2: *The de facto standard of 8-bit operating systems ready to load and go!*

ANOTHER PRIORITY 1 EXCLUSIVE!

We went to GODBOUT and made a special buy on the nucleous of the best S-100 Z80A systems ever.

LOOK AT WHAT YOU GET:

1 ICGBT160A *2/4 MHz Z80 CPU*	$295.00
1 ICGBT164A32 *32K 10MHz Static Ram*	$425.00
1 ICGBT171A *DMA Disk Controllers*	$495.00
1 ICGBTCPM80 *CP/M 2.2*	$175.00
IT ALL ADDS UP TO ..	$1390.00

TOTAL PACKAGE PRICE ONLY $1095.00
ORDER NO. ICPDBGBTSG

SUPERSIXTEEN — GODBOUT
LOOK WHAT $3495.00 WILL BUY!
WHY WAIT ANY LONGER?
HERE IS WHAT EACH PACKAGE INCLUDES:

ICGBT1612A *6 MHz 8085/8088 Dual Processor Board*
ICGBT171A *High Speed DMA Disk Controller*
ICGBT162A *System Support 1 Multi-Function Board*
ICGBT133A *Interfacer 1 Dual Serial I/O*
IC128K 10MHz *Low Power Static Ram*
ICGBTCP/M86 *16 Bit Operating System Ready to Load & Go*
Cables and Documentation *Three interfacer cables one disk I/O cable, complete documentator for all hardware, and manuals for both CP/M operating systems.*
Compu Pro's famous 1 Year *limited warranty.*

Now to the best part of all. If purchased separately, these quality components would list for $4,344.00. **BUT SuperSixteen's low package price is an amazing $3,495.00. You save $849.00!** *(For boards qualified under the Certified System Component high-reliability program - with extended 2 year warranty, 200 hour burn-in and 8 MHz processors - add $600.00 to the package price.* *Sh. Wt. 15 lbs.*

ICPDBGBTSJ	SuperSixteen A&T	$3495.00
ICPDBGBTSK	SuperSixteen CSC	$4095.00

S-100 SOFTWARE

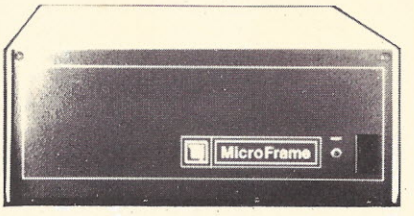
PRIORITY 1 is pleased to offer the finest in industry standard software. All software is supplied on 8" Single Density IBM 3740 CP/M compatable disketts. All software is sold "AS IS" and is non-returnable. If you have questions about the software for your application, order the manual first.

ICCCS803	*CP/M Version 2.2 Microcomputer Control Program*	$150.00
ICCCS2301	*MAC-CP/M Macro Assembler*	$90.00
ICCCS2401	*SID-CP/M Symbolic Instruction Debugger*	$75.00
ICCCS2501	*TEX-CP/M Text Formatter*	$75.00
ICCCS2601	*DESPOOL-CP/M Background Print Utility*	$50.00
ICMDSBAS80	*Microsoft Basic 80*	$200.00
ICMDSPAS/C	*Whitesmith's Pascal and C*	$900.00
ICMDSCCOMP	*Whitesmith C Compiler*	$700.00
ICMDSMFT	*Microsoft Fortran*	$400.00

CP/M, MAC, SID, TEX, and DESPOOL are registered trademarks of Digital Research

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
ICCCS401	*C-BASIC-2 Interp*	*$150.00*	$139.00
ICCCS401M	*Manual*		$ 32.00
ICCCS1101	*FMS-80 by Systems Plus*	*$995.00*	$895.00
ICCCS1101M	*Manual*		$ 70.00
	GRAHAM-DORIAN ACCOUNTING		
ICCCS1301	*General Ledger*	*$820.00*	$750.00
ICCCS1301M	*Manual*		$ 50.00
ICCCS1501	*Accounts Receivable*	*$820.00*	$750.00
ICCCS1501M	*Manual*		$ 50.00
ICCCS1401	*Accounts Payable*	*$820.00*	$750.00
ICCCS1401M	*Manual*		$ 50.00
ICCCS1701	*Inventory II*	*$820.00*	$750.00
ICCCS1701M	*Manual*		$ 50.00
ICCCS1601	*Payroll II*	*$555.00*	$495.00
ICCCS1601M	*Manual*		$ 50.00
ICCCS2001	*Job Costing*	*$820.00*	$750.00
ICCCS2001M	*Manual*		$ 50.00
ICCCS2701	*Order Entry/Invoice*	*$820.00*	$750.00
ICCCS2701M	*Manual*		$ 50.00
	MEDICAL PRACTICE PATIENT BILLING		
ICCCS1801	*15 PROGRAMS*	*$820.00*	$750.00
ICCCS1801M	*Manual*		$ 50.00
	DENTAL PRACTICE PATIENT BILLING		
ICCCS1901	*19 PROGRAMS*	*$820.00*	$750.00
ICCCS1901M	*Manual*		$ 50.00

S-100 MAINFRAMES



S-100 MICROFRAME - TEI

110V 60HZ CVT Mainframes, the best money can buy!
12 Slot ±8V 17A±16V @ 2A
22 Slot ±8V @ 30A± 6V @ 4A

PRIORITY 1 has delayed the 8% TEI Price Increase until March 1st. ORDER TODAY!

PART NO.		LIST PRICE	OUR PRICE 1-9	10-24
ICTEIMCS 112	*12 Slot Desk*	*$685.00*	$615.00	$570.00
ICTEIMCS 122	*22 Slot Desk*	*$825.00*	$760.00	$705.00
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			1-9	10-24
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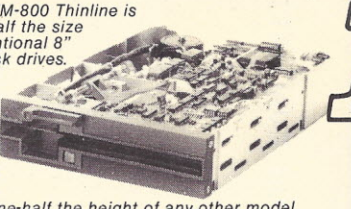

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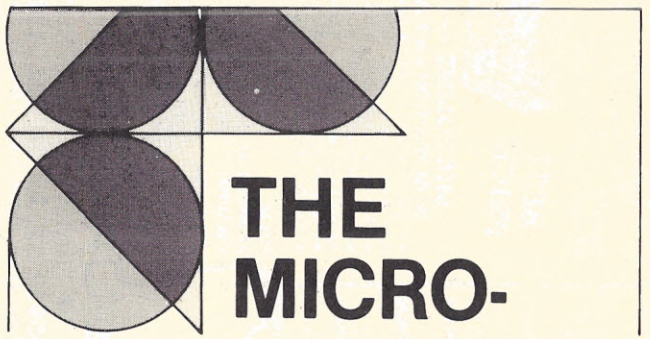
The Micro-Mathematician
Continued from page 42



THE MICRO-MATHEMATICIAN

by Dr. John C. Nash

Listing 1. Application of HJ method to the elliptical valley

```
HOOKE AND JEEVES - 811019
FUNCTION MINIMIZATION BY PATTERN SEARCH
NUMBER OF PARAMETERS=2
STEP-SIZE=1
STEP-SIZE REDUNCTION FACTOR=.1
TOLERANCE=1E-3
INITIAL B( 1)=?0
INITIAL B( 2)=?0
INITIAL FUNCTION VALUE= 320
Z(B)= 193 AT  1 0
Z(B)= 128 AT  1 1
PATTERN MOVE TO
STEPSIZE NOW  .001 Z= 0 IN  30
CONVERGED TO Z= 0  IN  30 FUNCTION EVALUATIONS
B( 1)= 6
B( 2)= -2
STOP IN LINE 235
READY
```

Listing 2. A Basic program for the Hooke and Jeeves method

```
10 PRINT "HOOKE AND JEEVES - 811019"
15 PRINT "FUNCTION MINIMIZATION BY PATTERN SEARCH"
20 REM HJIA AUTHOR J C NASH
25 LET D9=2 \ REM DEBUG SWITCH 0=OFF, 1=PARTIAL, 2=FULL
30 INPUT "NUMBER OF PARAMETERS=",N
35 DIM B(N),X(N)
40 REM THESE ARE THE ONLY PROGRAM DIMENSIONS
45 REM USER FUNCTION MAY NEED OTHERS
50 INPUT "STEP-SIZE=",D
55 INPUT "STEP-SIZE REDUNCTION FACTOR=",R9
60 INPUT "TOLERANCE=",T9
65 IF T9<=0 THEN 60
70 REM NOTE SAFETY CHECK, END STEP HJ1, START STEP HJ2
75 FOR I=1 TO N
80 PRINT "INITIAL B(",I,")=",
85 INPUT X(I)
90 NEXT I
95 REM STEP HJ3 COPY X INTO B USING SUBROUTINE
100 GOSUB 240
105 LET J=0 \ REM COUNTER FOR FUNCTION EVALUATIONS
110 REM STEP HJ4, COMPUTE A=Z(B)
115 GOSUB 500
120 LET B0=A
125 LET F=A
130 PRINT "INITIAL FUNCTION VALUE=",F
135 GOSUB 265 \ REM STEP HJ5, PERFORM AS
140 IF F>=B0 THEN 160 \ REM STEP HJ6
145 LET B0=F \ REM UPDATE FN VALUE AT BASE
150 GOSUB 345 \ REM PERFORM PM
155 GOTO 135
160 FOR I=1 TO N \ REM STEP HJ7
165 IF B(I)<>X(I) THEN EXIT 180
170 NEXT I
175 GOTO 195
180 GOSUB 240 \ REM COPY X INTO B
185 IF D9>0 THEN PRINT "RETURN TO OLD BASE POINT"
190 GOTO 135
195 LET D=R9*D \ REM STEP HJ8, REDUCE STEP-SIZE
200 IF D9>0 THEN PRINT "STEPSIZE NOW ",D," Z=",F," IN ",J
205 IF D>T9 THEN 135 \ REM STEP HJ9, CONVERGENCE TEST
```

```
B( 1)= 2
B( 2)= 2
Z(B)= 65 AT  3 2
Z(B)= 128 AT  3 3
Z(B)= 36 AT  3 1
PATTERN MOVE TO
B( 1)= 5
B( 2)= 1
Z(B)= 153 AT  6 1
Z(B)= 41 AT  4 1
Z(B)= 169 AT  5 2
Z(B)= 25 AT  5 0
PATTERN MOVE TO
B( 1)= 7
B( 2)= -1
Z(B)= 145 AT  8 -1
Z(B)= 17 AT  6 -1
Z(B)= 68 AT  6 0
Z(B)= 0 AT  6 -2
PATTERN MOVE TO
B( 1)= 7
B( 2)= -4
Z(B)= 16 AT  8 -4
Z(B)= 68 AT  6 -4
Z(B)= 4 AT  7 -3
Z(B)= 80 AT  7 -5
RETURN TO OLD BASE POINT
Z(B)= 17 AT  7 -2
Z(B)= 17 AT  5 -2
Z(B)= 17 AT  6 -1
Z(B)= 17 AT  6 -3
STEPSIZE NOW  .1 Z= 0 IN  22
Z(B)= .17 AT  6.1 -2
Z(B)= .17 AT  5.9 -2
Z(B)= .17 AT  6 -1.9
Z(B)= .17 AT  6 -2.1
STEPSIZE NOW  .01 Z= 0 IN  26
Z(B)= .0017 AT  6.01 -2
Z(B)= .0017 AT  5.99 -2
Z(B)= .0017 AT  6 -1.99
Z(B)= .0017 AT  6 -2.01
```

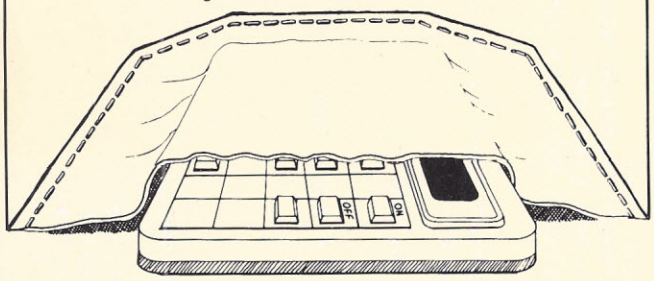
```
210 PRINT "CONVERGED TO Z=",F,"  IN ",
215 PRINT J," FUNCTION EVALUATIONS"
220 FOR I=1 TO N
225 PRINT "B(",I,")=",X(I)
230 NEXT I
235 STOP \ REM STEP HJ10
240 REM COPY X INTO B
245 FOR I=1 TO N
250 LET B(I)=X(I)
255 NEXT I
260 RETURN
265 REM AXIAL EXPLORATORY SEARCH (AS)
270 FOR I=1 TO N \ REM STEP AS1
275 LET G=B(I) \ REM STEP AS2
280 LET B(I)=G+D
285 GOSUB 500 \ REM STEP AS3
290 IF D9>1 THEN GOSUB 390
295 IF A<F THEN 330 \ REM STEP AS4
300 LET B(I)=G-D \ REM STEP AS5
305 GOSUB 500 \ REM STEP AS6
310 IF D9>1 THEN GOSUB 390
315 IF A<F THEN 330 \ REM STEP AS7
320 LET B(I)=G \ REM STEP AS8
325 GOTO 335
330 LET F=A \ REM STEP AS9
335 NEXT I \ REM STEP AS10
340 RETURN
345 REM PATTERN MOVE (PM)
350 IF D9>1 THEN PRINT "PATTERN MOVE TO "
355 FOR I=1 TO N \ REM STEP PM1
360 LET G=2*B(I)-X(I) \ REM STEP PM2
365 LET X(I)=B(I)
370 LET B(I)=G
375 IF D9>1 THEN PRINT "B(",I,")=",G
380 NEXT I \ REM STEP PM3
385 RETURN
390 PRINT "Z(B)=",A," AT ",
395 FOR K=1 TO N
400 PRINT B(K),
405 IF 5*INT(K/5)<>K THEN 420
410 PRINT
415 PRINT "     ",
420 NEXT K
425 PRINT
430 RETURN
500 REM ELLIPTICAL VALLEY
510 LET J=J+1
520 LET T1=B(1)+B(2)-4
530 LET T2=B(1)-B(2)-8
540 LET A=16*T1*T1+T2*T2
550 RETURN
```

Power in Your Pocket

Continued from page 55

POWER IN YOUR POCKET

by Bob McElwain



Program listing

```
 5: PRINT "LITTLE FAL"
```

- CLEAR is not used, as may need to hold data. Use CLEAR before RUN to clear all variable space.

```
    @                                  @
    @@@  SET INITIAL PARAMETERS  @@@
    @                                  @
```

- Set number of Columns (A) and rows (B). The product of the number of rows and columns with this form of the program cannot be greater than 41 plus the number of row headings required. Also set G, the number of variables used by the program. I and M are a part of this count and have not been used. Use as needed without changing the value of G.

```
10: A=10: B=4: G=13
```

- Get start for column heading. Decrease entry so that first increment will be to original value. Since this value is changed during each run, it must be entered on each run.

```
15: INPUT "BEGIN COL HEADS WITH? ";J: J=J-1
```

- Get number of columns to use. Use ENTER only to hold previous value.

```
20: INPUT "# OF COLS NEEDED? ";E
```

- Cannot exceed A, as set in Line 10. E must be greater than 1 or no comparison possible between columns.

```
25: IF (E>1)+(E<A-1)=2 THEN 35
```

- Note that column A-1 must be held for projection factor and column A must be held for computation.

```
30: K=A-2: PRINT "USE 1-";K;" TRY AGAIN.":
  : GO TO 20
```

- Get headings for rows. Save in A$(G+1) to A$(G+B). Use ENTER only to enter. Skip with any other character.

```
35: INPUT "ENTER ROW HEADS? ";K$: GO TO 60
40: FOR D=1 TO B
```

- Display previous value.

```
45: K=D+G: PRINT "ROW ";D;" WAS ";A$(K)
```

- Use ENTER only to hold previous value.

```
50: K=D+G: INPUT "NEW HEADING? ";A$(K)
55: NEXT D
```

- Get inflation factor, if any. Use ENTER only to hold previous value. If not to be used, zero must be entered.

```
60: INPUT "INFLATION %? ";F

    @                              @
    @@@  ENTER/EDIT DATA  @@@
    @                              @
```

- Use ENTER only if need. To skip, enter any character.

```
100: INPUT "ENTER/EDIT? ";K$: GO TO 200
```

- Loop for rows. Count is one less for index routine. Last row is ignored; it will be computed.

```
105: FOR D=0 TO B-2
```

- Loop for columns used.

```
110: FOR C=1 TO E
```

- Find index to element needed.

```
115: H=G+B+D*A+C
```

- Display previous value, preceeded by row, then column heading.

```
120: K=J+C: PRINT A$(G+D+1);" #";K;" ";A(H)
```

- Use ENTER only if present value correct.

```
125: INPUT "NEW? ";A(H)
130: NEXT C
135: NEXT D

    @                          @
    @@@  COMPUTE TOTALS  @@@
    @                          @
```

- Loop for column.

```
200: FOR C=1 TO E
```

- Go to calculation and display.

```
205: GO SUB 900
210: NEXT C

    @                                  @
    @@@  FIND TOTALS AND AVERAGE  @@@
    @                                  @
```

- Find totals and average of rows 1 to 13. None of the results are held. Any computations can be substituted for what's here.

```
300: FOR D=1 TO B
```

- Set for accumulation of total

```
305: K=0
```

- Loop for columns.

```
310: FOR C=1 TO E
```

- Accumulate.

```
315: H=G+B+(D-1)*A+C: K=K+A(H)
320: NEXT C
```

- Display total.

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```
325: PRINT A$(G+D);" ROW ";D;" TOT=";K
     - Compute average.  Round off to
       hundredths.
330: K=INT(K/E*100+.5)/100
     - Display.
335: L=G+D:PRINT A$(L);" ROW ";D;" AVE=";K
340: NEXT D
     @                          @
     @@@  PROJECTION FACTOR  @@@
     @                          @
     - Find a factor for projections.  A
       common choice will be a percentage of
       change as computed below.  Value must
       be held in Column  E+1 for use in
       projections.
     - Loop for rows.
500: D=0 TO B-2
     - Set to accumulate the ratio of the
       difference between columns compared
       to the first period.
505: K=0
     - Loop begins with 2 because must com-
       pare current column to previous.
510: FOR C=2 TO E
     - Find index to element needed.
515: H=G+B+D*A+C
     - Subtract first column from the second
       and divide the difference by the
       amount in the first column.
       Accumulate.
520: K=K+(A(H)-A(H-1))/A(H-1)
525: NEXT C
     - Compute average.  Round off.  Hold
       in column E+1.
530: H=G+B+D*A+E+1
535: A(H)=INT(K/(E-1)*10000+.5)/100
540: K=G+D+1: PRINT A$(K);" ";A(H);"%"
545: NEXT D
     - Get total.  Note that the column
       number will not report correctly
       on this GO SUB.
550: C=E+1: GO SUB 900
     @                          @
     @@@  INFLATION FACTOR  @@@
     @                          @
    - Skip, if inflation factor is zero.
      Otherwise decrease ratios saved by
      inflation factor.  This segment can
      be deleted if not needed.  If the
      inflation factor will always be used,
      it can be substracted directly in
      Line 535.
600: IF F=0 THEN 700
     - Loop for rows.  Ignore total.
605: FOR D=0 TO B-1
     - Find index.  The column needed is E+1.
610: H=G+B+D*A+E+1
615: K=G+D+1: PRINT A$(K);" WAS ";A(H)
     - Decrease by inflation factor.
620: A(H)=A(H)-F
625: PRINT A$(K);" NOW ";A(H)
630: NEXT D
     @                          @
     @@@  PROJECTIONS  @@@
     @                          @
     - Move last column of data (column E)
       to column E+2 for calculation with-
       out disturbing original data.  Totals
       will not be projected; they will be
       computed.
700: FOR D=0 TO B-2
     - Find index.  Use column E.
705: H=G+B+D*A+E
     - Copy from column E to column E+2.
710: A(H+2)=A(H)
715: NEXT D
     - Make projections, one column at a time.
       Set counter for subroutine.
720: C=E
     - Increase column counter.
725: J=J+1
     - Loop for rows.
730: FOR D=0 TO B-2
     - Find index.  Work from and to
       column E+2.
735: H=G+B+D*A+E+2
     - Compute projections and hold in place
       of previous value.  Rate adjustment
       held in column E+1, equivalent to H-1.
740: A(H)=INT(A(H)*(1+A(H-1)/100)*100+.5)/100
745: L=G+D+1: K=C+J
   : PRINT A$(L);" #";K;" ";A(H)
750: NEXT D
     - Get total.
755: GO SUB 900
     - Use ENTER only for another projection.
       Use any character to exit.  This line
       can be deleted.
760: INPUT "ANOTHER? ";K$: GO TO 999
765: GO TO 725
     @                      @
     @@@  SUBROUTINE  @@@
     @                      @
     Subroutine:  Compute column totals.
     - Find index to first element in
       column.
900: H=G+B+C
     - Total will be saved in last row.
       Note:  Change signs of operation to
       suit.  Also add or subtract factors
       IF number of rows is changed.
       A(H) is elements in first row.
       A(H+A) is element in second row.
       A(H+2*A) is element in third row.
       A(H+(B-1)*A) is element in last row.
     - Note:  As needed, add A(H+3*A) as an
       element in a fourth row, A(H+4*A) as
       an element in a fifth row, etc.
905: A(H+(B-1)*A(H)-A(H+A)-A(H+2*A)
     - Display result, preceeded by headings.
910: L=G+B: K=J+C: H=H+(B-1)*A
```

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```
915: PRINT A$(L);" #";K;" ";A(H)
920: RETURN
999: END
```

Sample run

In this sample run, some prompts have been omitted or changed slightly to improve readability.

```
LITTLE FAL
BEGIN COL HEADS WITH? 1978
# OF COLS NEEDED? 4
ENTER ROW HEADS? ENTER
ROW 1? SALES
ROW 2? C/SALES
ROW 3? C/GOODS
ROW 4? NET
INFLATION %? 0
(7% was used on re-run to produce the last
three columns of the table.  This is not
shown in the sample run.)

ENTER/EDIT? ENTER
(enter initial data)
SALES 1978? 34.5
SALES 1979? 38.4
SALES 1980? 41.7
SALES 1981? 48.6
C/SALES 1978? 5.9
C/SALES 1979? 4.8
C/SALES 1980? 4.2
C/SALES 1981? 3.8
C/GOODS 1978? 18.6
C/GOODS 1979? 20.4
C/GOODS 1980? 22.7
C/GOODS 1981? 25.1

(computed column totals.)
NET 1978 10.
NET 1979 13.2
NET 1980 14.8
NET 1981 19.7

(Computed totals and average for each row.)
SALES ROW 1 TOT=163.2
SALES ROW 1 AVE=40.8
C/SALES ROW 2 TOT=18.7
C/SALES ROW 2 AVE=4.68
C/GOODS ROW 3 TOT=86.8
C/GOODS ROW 3 AVE=21.7
NET ROW 4 TOT=57.7
NET ROW 4 AVE=14.43

(Computed average change as a percent.)
SALES 12.15%
C/SALES -13.56%
C/GOODS 10.51%
NET 15.2%

(Computed Projections.)
SALES 1982 54.5
C/SALES 1982 3.28
C/GOODS 1982 27.74
NET 1982 23.48
ANOTHER? ENTER
SALES 1983 61.12
C/SALES 1983 2.84
C/GOODS 1983 30.66
NET 1983 27.62
ANOTHER?
(RUN can continue with ENTER only.)
```

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Writing Off Real Estate

Continued from page 97

Program listing

```
200 '
    SET UP DEFINITIONS & ARRAYS
210 DEFINTN,M,Y,K:F$="$$####,###,###.##"
220 DIMP(13,17):DIMQ(13,17) 'P IS LOWINCOME. Q IS NON-LOWINCOME
300 '
    MENU
310 CLS:PRINTTAB(12)" REAL PROPERTY COST RECOVERY":PRINTTAB(15)"UNDER THE 1981 TAX ACT"
320 PRINT:PRINT"<ACCELERATED COST RECOVERY SYSTEM (ACRS) AND STRAIGHT LINE>
330 PRINT:PRINT"  1. DISPLAY TABLE OF ACRS PERCENTAGES (LOW-INCOME HOUSING)":PRINT
340 PRINT"  2. DISPLAY TABLE OF ACRS PERCENTAGES (NON-LOW-INCOME HOUSING)
350 PRINT"  3. COMPUTE DEPRECIATION SCHEDULE (LOW-INCOME HOUSING)":PRINT
360 PRINT"  4. COMPUTE DEPRECIATION SCHEDULE (NON-LOW-INCOME HOUSING)":PRINT
370 PRINT:PRINT"PATIENCE, PLEASE ---- FILLING IN SCHEDULE.";
380 IFKF=0GOSUB510
390 KF=1
400 PRINTCHR$(29);CHR$(31);:PRINT"YOUR CHOICE ?"
410 A$=INKEY$:IFA$=""THEN410 ELSEIFA$<"1"THEN410 ELSEIFA$>"4"THEN410
420 A%=VAL(A$)
430 ONA%GOTO600 ,600 ,2000 ,2000
500 '
    FILL ARRAY WITH PERCENTAGE DATA
510 FORY=1TO16
520 FORM=1TO12
530 READP(M,Y)
540 NEXTM
550 NEXTY
560 FORY=1TO16:FORM=1TO12
570 READQ(M,Y)
580 NEXTM:NEXTY
590 RETURN
600 '
    DISPLAY PERCENTAGES
610 GOSUB810
620 Y=1
630 N=200:N2=192
640 FORM=1TO12
650 PRINT@N2,Y;:IFA%=1PRINT@N,P(M,Y);:N=N+4:GOTO670
660 IFA%=2PRINT@N,Q(M,Y);:N=N+4
670 NEXTM
680 N2=N2+64:N=N+16
690 IFY=12THENPRINT:PRINT"PRESS A KEY TO CONTINUE.";:ELSE710
700 A$=INKEY$:IFA$=""THEN700 ELSECLS:N2=192:N=200:GOSUB810
710 Y=Y+1:IFY=17GOTO730
720 GOTO640
730 PRINT:PRINT"PRESS A KEY FOR MENU."
740 A$=INKEY$:IFA$=""THEN740 ELSE310
800 '
    HEADINGS FOR DISPLAY OF PERCENTAGES
810 CLS:PRINT"SCHEDULE OF APPLICABLE PERCENTAGES";
820 IFA%=1PRINT" (LOW-INC. HOUSING)":GOTO840
830 IFA%=2PRINT" (NON-LOW-INC. HOUSING)"
840 PRINT"MONTH:  1  2  3  4  5  6  7  8  9 10 11 12"
850 PRINT"YEAR:   ";STRING$(47,131)
860 RETURN
1000 '
DATA FOR LOW-INCOME HOUSING
1010 DATA13,12,11,10,9,8,7,6,4,3,2,1
1020 DATA12,12,12,12,12,12,12,13,13,13,13,13
1030 DATA10,10,10,10,11,11,11,11,11,11,11,11
1040 DATA9,9,9,9,9,9,9,9,10,10,10,10
1050 DATA8,8,8,8,8,8,8,8,8,8,8,9
1060 DATA7,7,7,7,7,7,7,7,7,7,7,7
1070 DATA6,6,6,6,6,6,6,6,6,6,6,6
1080 DATA5,5,5,5,5,5,5,5,5,5,6,6
3170 PRINT:PRINT"PRESS A KEY FOR MENU."
3180 A$=INKEY$:IFA$=""THEN3180 ELSE310
4000 '
    HEADINGS FOR SCREEN DISPLAY
4010 CLS:IFA%=3THENPRINT"LOW-INCOME HOUSING ";ELSEIFA%=4THENPRINT"NON-LOW-INCOME HOUSING
";
4020 PRINTTAB(28)"BASIS = ";:PRINTUSINGF$;BA#
4030 PRINT"PLACED IN SERVICE IN MONTH";MO%;"OF YEAR";YR%
4040 IFB2%=1THENPRINT"USING 15-YEAR A.C.R.S. METHOD."ELSE PRINT"STRAIGHT LINE METHOD,";YL%;"Y
EARS."
4050 PRINT"TAX YEAR";TAB(20)"AMT.RECOVERED";TAB(40)"BASIS BALANCE"
4060 RETURN
5000 '
    HEADINGS FOR LINE PRINTER DISPLAY
5010 IFPEEK(14312)<>63PRINT"PRINTER NOT ON LINE.";:GOTO2100
5020 LPRINTCHR$(15) 'START UNDERLINE ON CENTRONICS 747
5030 CLS:PRINT"NOW PRINTING SCHEDULE"
5040 LPRINT"COST RECOVERY SCHEDULE FOR";
5050 IFA%=3LPRINT" LOW-INCOME HOUSING":GOTO5070
5060 IFA%=4LPRINT" NON-LOW-INCOME HOUSING"
5070 LPRINTCHR$(14); 'STOP UNDERLINE ON CENTRONICS 747
5080 LPRINT"BASIS = ";:LPRINTUSINGF$;BA#
5090 LPRINT"PLACED IN SERVICE IN MONTH";MO%;"OF YEAR";YR%
5100 IFB2%=1THENLPRINT"USING 15-YEAR A.C.R.S. METHOD."ELSELPRINT"USING STRAIGHT LINE METHOD,
";YL%;"YEARS."
5110 LPRINTCHR$(138)
5120 LPRINT"TAX YEAR";TAB(16)"AMOUNT RECOVERED";TAB(39)"BASIS BALANCE"
5130 LPRINTCHR$(138)
5140 RETURN
```

Sample run

```
COST RECOVERY SCHEDULE FOR LOW-INCOME HOUSING
BASIS =       $100,000.00
PLACED IN SERVICE IN MONTH 1 OF YEAR 1980
USING 15-YEAR A.C.R.S. METHOD.

TAX YEAR          AMOUNT RECOVERED          BASIS BALANCE

 1980                $13,000.00              $87,000.00
 1981                $12,000.00              $75,000.00
 1982                $10,000.00              $65,000.00
 1983                 $9,000.00              $56,000.00
 1984                 $8,000.00              $48,000.00
 1985                 $7,000.00              $41,000.00
 1986                 $6,000.00              $35,000.00
 1987                 $5,000.00              $30,000.00
 1988                 $5,000.00              $25,000.00
 1989                 $5,000.00              $20,000.00
 1990                 $4,000.00              $16,000.00
 1991                 $4,000.00              $12,000.00

COST RECOVERY SCHEDULE FOR NON-LOW-INCOME HOUSING
BASIS =       $100,000.00
PLACED IN SERVICE IN MONTH 1 OF YEAR 1982
USING 15-YEAR A.C.R.S. METHOD.
```

```
1090 DATA5,5,5,5,5,5,5,5,5,5,5
1100 DATA5,5,5,5,5,5,5,5,5,5,5
1110 DATA4,5,5,5,5,5,5,5,5,5,5
1120 DATA4,4,4,5,4,5,5,5,5,5,5
1130 DATA4,4,4,4,4,4,5,4,5,5,5
1140 DATA4,4,4,4,4,4,4,4,4,5,4,4
1150 DATA4,4,4,4,4,4,4,4,4,4,4,4
1160 DATA0,0,1,1,2,2,2,3,3,4,4
1200 '
DATA FOR ALL OTHER REAL ESTATE (NON-LOW-INCOME)
1210 DATA12,11,10,9,8,7,6,5,4,3,2,1
1220 DATA10,10,11,11,11,11,11,11,11,11,11,12
1230 DATA9,9,9,9,10,10,10,10,10,10,10,10
1240 DATA8,8,8,8,8,8,8,9,9,9,9,9
1250 DATA7,7,7,7,7,7,8,8,8,8,8,8
1260 DATA6,6,6,6,7,7,7,7,7,7,7,7
1270 DATA6,6,6,6,6,6,6,6,6,6,6,6
1280 DATA6,6,6,6,6,6,5,6,6,6,6,6
1290 DATA6,6,6,6,5,6,5,5,5,6,6,6
1300 DATA5,6,5,6,5,5,5,5,5,5,6,5
1310 DATA5,5,5,5,5,5,5,5,5,5,5,5
1320 DATA5,5,5,5,5,5,5,5,5,5,5,5
1330 DATA5,5,5,5,5,5,5,5,5,5,5,5
1340 DATA5,5,5,5,5,5,5,5,5,5,5,5
1350 DATA5,5,5,5,5,5,5,5,5,5,5,5
1360 DATA0,0,1,1,2,2,3,3,4,4,4,5
2000 '
     DATA INPUT FOR COST RECOVERY SCHEDULE
2010 CLS:PRINT"PLEASE ENTER THE FOLLOWING INFORMATION:"
2020 PRINT"(EXISTING VALUES ARE SHOWN IN BRACKETS; PRESS <ENTER> IF O.K.)"
2030 PRINT:PRINT"   INITIAL BASIS";TAB(22)"<";:PRINTUSINGF$;BA#;:PRINT">";TAB(45)"";:INPUTBA#:BB#=B
A#
2040 PRINT"   YEAR PLACED IN USE";TAB(32)"<";YR%;">";TAB(45)"";:INPUTYR%
2050 PRINT"   MONTH PLACED IN USE (1-12)";TAB(35)"<";MO%;">";TAB(45)"";:INPUTMO%:IFMO%<1ORMO%>12T
HENPRINTCHR$(27);CHR$(30);CHR$(29);:GOTO2050
2060 PRINT"   DEPRECIATION METHOD:":PRINTTAB(10)"(1) A.C.R.S. 15-YEAR OR":PRINTTAB(10)"(2) STRAIGHT
 LINE ?
2070 A$=INKEY$:IFA$=""THEN2070 ELSEIFA$<"1"THEN2070 ELSEIFA$>"2"THEN2070
2080 B2%=VAL(A$)
2090 IFB2%=2INPUT"     HOW MANY YEARS (15, 35, OR 45)";YL%
2100 PRINT:PRINT"DO YOU WISH:":PRINT"   1. DISPLAY ON SCREEN":PRINT"   2. OUTPUT TO PRINTER":PRIN
T"   3. CHANGE THE ABOVE DATA ?"
2110 A$=INKEY$:IFA$=""THEN2110 ELSEIFA$<"1"THEN2110 ELSEIFA$>"3"THEN2110
2120 B%=VAL(A$):ONB%GOTO3000 ,3000 ,2000
2130 B2%=VAL(A$)
3000 '
     COMPUTATION OF COST RECOVERY SCHEDULE
3010 IFB%=1THENGOSUB4000 ELSEIFB%=2GOSUB5000
3020 Y%=0
3030 Y%=Y%+1
3040 IFB%=1THENPRINTYR%;ELSEIFB%=2LPRINTYR%;
3050 IFB2%=2 AND Y%=YL%+1 THEN DE#=BB#:GOTO3100 '
FRACTIONAL LAST YEAR, ST. LINE
3060 IFB2%=2 AND Y%>1 THEN DE#=BA#/YL%:GOTO3100 '
OTHER THAN FIRST OR LAST YEAR, ST. LINE
3070 IFB2%=2 AND Y%=1 THEN DE#=BA#*(13-MO%)/(YL%*12):GOTO3100 '
FRACTIONAL FIRST YEAR, ST. LINE
3080 IFA%=3THENDE#=BA#*P(MO%,Y%)/100:GOTO3100 '
a.c.r.s. LOW-INCOME HOUSING
3090 IFA%=4THENDE#=BA#*Q(MO%,Y%)/100'
a.C.R.S. NON-LOW-INCOME
3100 IFB%=1THENPRINTTAB(16)USINGF$;DE#;ELSEIFB%=2THENLPRINTTAB(16)USINGF$;DE#;
3110 BB#=BB#-DE#
3120 IFB%=1THENPRINTTAB(36)USINGF$;BB#ELSEIFB%=2LPRINTTAB(36)USINGF$;BB#
3130 YR%=YR%+1:IFB%=1ANDY%/10=INT(Y%/10)THENPRINT"PRESS A KEY TO CONTINUE."ELSE3150
3140 A$=INKEY$:IFA$=""THEN3140 ELSECLS:GOSUB4050
3150 IFB2%=1THENIFY%=16GOTO3170 ELSE3030
3160 IFY%=YL%+1GOTO3170 ELSE3030
```

TAX YEAR	AMOUNT RECOVERED	BASIS BALANCE
1982	$12,000.00	$88,000.00
1983	$10,000.00	$78,000.00
1984	$9,000.00	$69,000.00
1985	$8,000.00	$61,000.00
1986	$7,000.00	$54,000.00
1987	$6,000.00	$48,000.00
1988	$6,000.00	$42,000.00
1989	$6,000.00	$36,000.00
1990	$6,000.00	$30,000.00
1991	$5,000.00	$25,000.00
1992	$5,000.00	$20,000.00
1993	$5,000.00	$15,000.00
1994	$5,000.00	$10,000.00
1995	$5,000.00	$5,000.00
1996	$5,000.00	$0.00
1997	$0.00	$0.00

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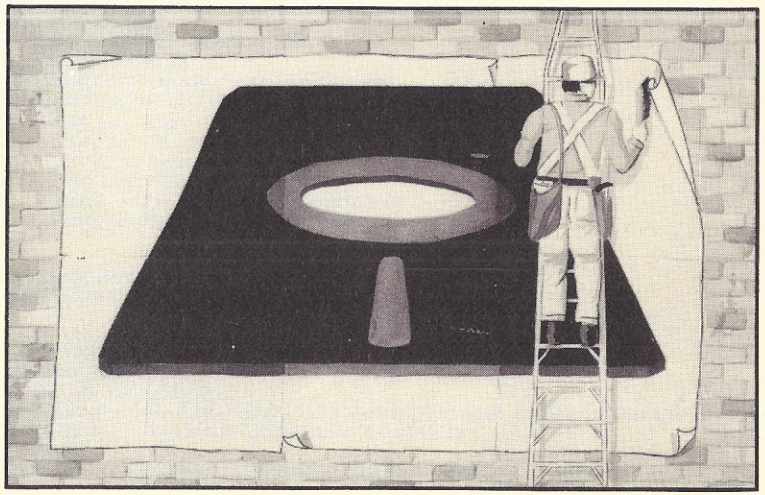
TAX YEAR	AMOUNT RECOVERED	BASIS BALANCE
1982	$6,666.67	$93,333.33
1983	$6,666.67	$86,666.67
1984	$6,666.67	$80,000.00
1985	$6,666.67	$73,333.33
1986	$6,666.67	$66,666.67
1987	$6,666.67	$60,000.00
1988	$6,666.67	$53,333.33
1989	$6,666.67	$46,666.67
1990	$6,666.67	$40,000.00
1991	$6,666.67	$33,333.33
1992	$6,666.67	$26,666.67
1993	$6,666.67	$20,000.00
1994	$6,666.67	$13,333.33
1995	$6,666.67	$6,666.67
1996	$6,666.67	$0.00
1997	$0.00	$0.00

Catalog Builder

Continued from page 98



Program listing

```
10 PRINT "CATDAJN - CATALOG OF NORTH STAR DISKETTES"
20 REM D J ANDERSON AND J C NASH
30 REM VERSION OF JUNE 1981 FROM JULY 1980 ORIGINAL
40 DIM N$(8),S$(8),F$(10),X$(1),T$(25)
50 REM N$ - DISK NAME
60 REM S$ - TEMPORARY STORE FOR ENTRY NAME
70 REM F$ - FILE NAME FOR CATALOG AFTER IT IS BUILT
80 LET R9=0 \ REM START OF RAM AREA TO HOLD CATALOG OF A DISK
90 LET D1=0 \ REM INITIAL OUTPUT DEVICE IS SCREEN
100 LET Q9=FREE(0)-2000 \ REM SPACE FOR CATALOG LESS BUFFERS
110 LET Q9=INT(Q9/24) \ REM NUMBER OF ENTRIES
120 DIM Q$(24*Q9) \ REM RESERVE IT
130 LET Q1=0 \ REM START WITH NO ENTRIES
140 REM EACH ENTRY HAS STRUCTURE --
150 REM FILENAME(8), DISKNAME(8),DISKADDRESS(2),FILESIZE(2),
160 REM FILETYPE(1),OTHERINFORMATION(3)
170 GOSUB 340 \ REM LOAD DISK READ PROGRAM
180 PRINT "SPACE FOR ",Q9," ENTRIES IN CATALOG"
190 PRINT "INSERT DISK - TYPE (CR) OR 'Q'",
200 INPUT X$
210 IF LEN(X$)=0 THEN 230
220 IF X$(1,1)="Q" THEN 280 \ REM TEST FOR QUIT
230 LET R=CALL(7680,R9) \ REM CALL TO READ CATALOG INTO RAM
240 GOSUB 540 \ REM DISK NAME
250 IF P<0 THEN 190 \ REM NONAME
260 GOSUB 690 \ REM GET REST OF INFORMATION & PUT IN PLACE
630 RETURN
640 FOR K=1 TO 8 \ REM FOUND NAME SO SAVE IT IN N$
650 LET N$(K,K)=CHR$(EXAM(P+K-1))
660 NEXT K
670 PRINT "DISK:",N$
680 RETURN
690 REM UNLOAD CATALOG NOW NAME IN N$
700 FOR J=0 TO 63 \ REM TEST ALL ENTRIES
710 LET P=16*J+R9 \ REM RAM LOCATION
720 FOR K=1 TO 8 \ LET S$(K,K)=CHR$(EXAM(K+P-1)) \ NEXT K
730 IF S$=N$ THEN 810 \ REM NOT INTERSETED IN DISKNAME
740 IF S$(1,1)=" " THEN 810 \ REM NOT INTERESTED IN BLANKS
750 IF EXAM(P+8)+EXAM(P+9)=0 THEN 810 \ REM NOR COMMENTS AT 0
760 LET T$(1,8)=S$ \ LET T$(9,16)=N$ \ REM BUILD ENTRY
770 FOR K=17 TO 24 \ LET T$(K,K)=CHR$(EXAM(P+K-9)) \ NEXT K
780 REM NOW HAVE FULL ENTRY, INSERT IN CATALOG
790 GOSUB 830
800 IF Q1=Q9 THEN EXIT 820 \ REM FULL CATALOG
810 NEXT J \ REM NEXT ENTRY
820 RETURN \ REM GET ANOTHER DISK
830 REM INSERT T$ IN PLACE IN CATALOG IN MEMORY
840 IF Q1=0 THEN 890 \ REM ADD AT "END"
850 FOR I=1 TO Q1
860 LET P=24*(I-1)
870 IF T$<Q$(P+1,P+24) THEN EXIT 920 \ REM INTSERTION TEST
880 NEXT I
890 LET P=24*Q1
900 LET Q$(P+1,P+24)=T$ \ REM ADD AT END
910 GOTO 980
920 FOR K=Q1 TO I STEP -1 \ REM PERFORM SPACE MAKING
930 REM IN REVERSE ORDER OR LOSE INFORMATION
940 LET R=24*K \ REM NOTE NO SUBTRACTION
950 LET Q$(R+1,R+24)=Q$(R-23,R) \ REM SHIFT RIGHT
960 NEXT K
970 LET Q$(P+1,P+24)=T$
980 LET Q1=Q1+1 \ REM NOTE INCREASE IN CATALOG
990 PRINT "ENTRY #",Q1,":",
1000 GOSUB 1020 \ REM PRINT T$
1010 RETURN \ REM END INSERT
1020 REM PRINT T$
1030 PRINT #D1,T$(1,8),TAB(12)," ",T$(9,16),
1040 LET R=ASC(T$(17,17))+256*ASC(T$(18,18))
1050 PRINT #D1,TAB(24),R, \ REM FILE ADDRESS ON DISK
1060 LET R=ASC(T$(19,19))+256*ASC(T$(20,20))
1070 PRINT #D1,TAB(32),R, \ REM FILE SIZE
1080 LET R=ASC(T$(21,21))
1090 PRINT #D1,TAB(40),R \ REM FILE TYPE
1100 REM IGNORE REST OF INFORMATION
1110 RETURN
1120 REM FILE OUTPUT
1130 PRINT "FILENAME FOR CATALOG (OR BLANK)",
1140 INPUT F$
1150 IF LEN(F$)=0 THEN RETURN
1160 IF F$(1,1)=" " THEN RETURN
1170 IF FILE(F$)=-1 THEN 1190
```

```
270 IF Q1<Q9 THEN 190  \ REM ANOTHER DISK?
280 GOSUB 1120 \ REM FILE FOR CATALOG
290 PRINT "LIST CATALOG (Y OR N)",
300 INPUT X$
310 IF X$(1,1)<>"Y" THEN STOP
320 GOSUB 1300
330 STOP
340 REM LOAD DISK READ PROGRAM
350 RESTORE 410 \ REM DATA STARTS AT 410 FOR PROGRAM
360 LET J=7680 \ REM PUT CODE AT 7680D = 1E00H
370 READ I \ FILL J,I \ REM GET BYTE AND PUT IN PLACE
380 IF I=201 THEN RETURN \ REM 201D = C9H = 'RET'
390 LET J=J+1 \ REM INCREMENT PROGRAM COUNTER
400 GOTO 370 \ REM NEXT BYTE
410 DATA 62 \ REM 3EH = MVI A,DATA8
420 DATA 4 \ REM 4 BLOCKS TO BE TRANSFERRED
430 DATA 6 \ REM 06H = MVI B,DATA8
440 DATA 1 \ REM 1 =>= READ FROM DISK
450 DATA 14 \ REM 0EH = MVI C,DATA8
460 DATA 1 \ REM DRIVE #1 USED
470 DATA 33 \ REM 21H = LXI H,DATA16
480 DATA 0,0 \ REM 0000H, ADDRESS OF CATALOG ON DISK
490 DATA 205 \ REM CDH = CALL ADDRESS
500 DATA 34 \ REM 22H = LOW ORDER ADDRESS BYTE
510 DATA 32 \ REM 20H = HIGH ORDER ADDRESS BYTE
520 REM THUS HAVE CD 22 20 == CALL 2022H (DCOM)
530 DATA 201 \ REM C9H = RET
540 REM EXTRACT DISK NAME
550 FOR J=0 TO 63 \ REM 64 POSSIBLE ENTRIES
560 LET P=J*16+R9 \ REM RAM POSITION
570 IF EXAM(P)=32 THEN 600 \ REM NO BLANK IN FIRST POSITION
580 IF EXAM(P+8)+EXAM(P+9) = 0 THEN EXIT 640
590 REM USE ZERO DISK ADDRESS TO FLAG DISK NAME
600 NEXT J
610 LET P=-1 \ REM FLAG NONAME STATUS
620 PRINT "DISK HAS NO NAME"
```

```
1180 IF FILE(F$)=3 THEN 1220 ELSE 1120
1190 PRINT "FILESIZE IN BLOCKS (MIN=",INT(Q1*26/256)+1,")",
1200 INPUT R
1210 CREATE F$,R
1220 OPEN#1,F$
1230 FOR I=1 TO Q1
1240 LET P=24*(I-1)
1250 LET T$=Q$(P+1,P+24)
1260 WRITE#1,T$
1270 NEXT I
1280 CLOSE#1
1290 RETURN
1300 REM PRINT CATALOG FROM MEMORY
1310 PRINT "SCREEN OR PRINTER",
1320 INPUT X$
1330 IF X$(1,1)="S" THEN 1360
1340 IF X$(1,1)<>"P" THEN 1310
1350 LET D1=3 \ REM DEVICE 3 IS PRINTER - CHANGE AS NEEDED
1360 INPUT "LINES/PAGE=",L
1370 GOSUB 1470
1380 FOR I=1 TO Q1 \ REM LOOP OVER ENTRIES
1390 LET R=24*(I-1)
1400 LET T$=Q$(R+1,R+24)
1410 GOSUB 1020 \ REM PRINT IT
1420 LET L9=L9+1
1430 IF L9=L THEN GOSUB 1470
1440 NEXT I
1450 FOR I=L9+1 TO L \ PRINT #D1 \ NEXT I
1460 RETURN
1470 PRINT #D1 \ PRINT #D1 \PRINT #D1
1480 PRINT #D1,"FILENAME",TAB(12),"DISKNAME",TAB(24),"ADDR",
1490 PRINT #D1,TAB(32),"SIZE",TAB(40),"TYPE"
1500 PRINT #D1
1510 LET L9=5
1520 RETURN
1530 END
```

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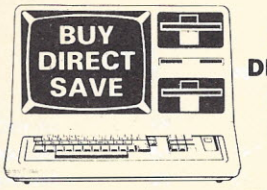

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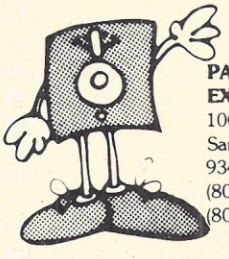

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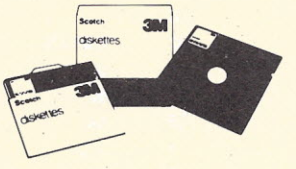

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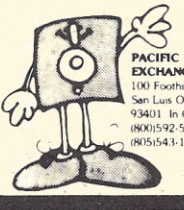

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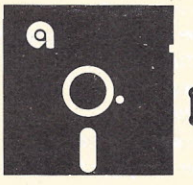

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